



# Inuentions or Deuises.

Very necessary for all Ge-  
neralles and Captaines, or Lea-  
ders of men, as wel by Sea as  
by Land: Written by  
*William Bourne.*  
*An. 1578.*



At LONDON  
Printed for Thomas Woodco,  
dwelling in Paules Churchyard,  
at the signe of the black  
Beare.



Instructions

or Dealers.

Very necessary for all

who are engaged in the

business of

the land: William

W. W. W.

W. W. W.

London

Printed at the

of the

at the





To the right Honourable his singular good Lorde, the Lorde  
Charles Howard, Baron of Effingham, Knight of the most noble  
order of the Garter.



Ondering with my selfe  
(right noble and worthie  
Lorde) howe I might by  
some meanes or waies, shew  
my selfe in any respect,  
partely to requite your  
Honourable Lo: great gentlenes and good countenance alwayes borne towards me from time to time, I could not holde my selfe satisfied, vntill I had some thing to present vnto your Lordship, whereupon I am so bolde as to dedicate this rude and simple Treatise vnto your worthynesse, hoping that you will accept it, as a true token and a signe of my good Will towards your humble Lordship. The thing is such, as you haue already seene the written copie at

## **The Epistle Dedicatorie.**

*my good Lord and Masters hande the Earle of  
Lincolne: the content thereof is, as touching  
Inuentions or Deuises, and first of Martiall  
affayres by Sea, and concerning ships: and then  
doe folowe deuises appertaining vnto Ordi-  
nance: and in like manner Deuises of the walls  
of towns, Castels and Forts: and also there are  
Deuises as touching Martiall affayres by land,  
with other such like, as the Contents of the ta-  
ble in the beginning of the booke dooth shew. (I  
hoping that your good Lordship will take these  
simple and rude Deuises in good parte) beseech  
God to prosper your Honour in all your attēpts,  
and to giue happy succeſſe in all your doings,  
with increase of Honour, and long life, in per-  
fect health. Amen.*

**By your Honours at commandement,**

**William Bourne.**





### *The Preface to the Reader.*



Riendlie Reader, it is possible that you may dislike of mee, for that I am so bould, as to publish these hard and difficult matters of diuers newe Inuentions or Deuises, the which some of them I haue gathered by one meane, & some by another, but the most part of them hath been mine owne inuention vpon sundry causes in the affaires that I haue had to doo. And as it may chance at sometime any person may be driven vnto an extremitie, and the thing seemeth vnpossible to bee auoyded, yet by some small and slender Deuise the danger thereof may bee preuented, whereas otherwise the perill thereof must needs haue happened: and yet that thing that hath preuented the cause, hath been thought to bee of no importance when that it hath beene knowne, and before it hath been known it hath seemed most vnpossible: wherefore I haue thought it good for to drawe them together into this rude and barbarous volume, more for that to haue them in remembrance, if that there dooth happen any cause to vse them, than the finesse of the writing or penning of them, for the writer thereof is most vnlearned and simple, desiring you gentle Reader, to beare with my rudenesse, considering that it is the good will that I

doo beare vnto my native Countrey, for to profit the common wealth as much as lieth in me, which is the occasion that hath made mee to write these rude and simple *Inuentions* or *Deuises*: Although there is no doubt, but that there be a great number of most excellent and Politique and wiser or finer heades: that I being so rude and simple a person, to presume to be a medler in those causes, for that the first inuentions or Deuises is are concerning matters by Sea and ships, both in martiall affayres and otherwise therevnto appertaining: And also there be Inuentions or Deuises of Ordinance, as well for seruice as otherwise therevnto appertaining: and also there be Inuentions or Deuises, as touching the walles of cities, townes or castels appertaining vnto Martiall affayres: & in like manner there be Inuentions or Deuises, as touching matters in the field, as wel meet for Generalles as for Captaines or leaders of mē, with other necessary Deuises or Inuentions, as in the table following it doth appeare, the which Inuentions or Deuises are verie necessary to bee had in memory, although that it is possible that those men that hath bin trayned of long time in Martiall affaires, perhaps may or doo know a great number of better Deuises than these, yet notwithstanding I haue written these, and although for their simpleness they wil do them no good, yet I am assured that they wil or can do the no hurt, although that they bee but of a simple mans inuenting, for all Artes, Sciences, or faculties, had a beginning before they came vnto their perfection: and yet it is possible there hath bin diuers inuentions that haue come  
vnto



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Vnto no perfection or purpose, and yet notwithstanding they are rather to bee better commended than those persons that haue great reuenues or liuings of their owne, yea and some haue great liuings of the Queenes highnesse, & yet they do practise no other thing, but how to liue easily, to satisfie their lust and pleasure, and some of them, if they doo practise any thing, that shal be but mischief in the cōmon wealth, &c. For by practising, they may attaine vnto knowledge in any affayres, though it be possible that some will say that in Martiall affaires that practise is to no purpose, if that hee haue not seene the seruice in the field. And also it may be saide againe, that there is a number that haue seene seruice in the fiede, and yet haue no iudgement at al in those affaires, for that we may see by common experience, that some persons haue been trained vp all the dayes of their life, to goe vnto the sea 20. 30. and 40. yeares, and yet haue no knowledge to be the Master of a ship to take charge, for that they wil practise nothing: & other some persons by practise be able to take charge in the space of 3. or 4. yeres, and be as sufficient men as those, to take charg, that haue bin masters the space of 20. yeres, &c. Wherefore we may see y<sup>e</sup> practise doth much auaille, for by practise he that hath seen but a litle experience of seruice, by cōsideratiō of that seruice that he hath seen, may practise further: for it is not possible if a mā had seen seruice a hundreth yeres, yet at a time in seruice in the field there may happen such a matter, that in al that time the like hath not bin seene nor happened: therefore in the reading of such authors as haue  
written

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written in any affayres, although that hee hath had no great experience in the matter, yet practise shall much auaille him: so that you may conclude, that he that hath seene much and hath neuer practised nothing, can haue no iudgement in any matter, then you must needs confesse, that hee that hath seene little and dooth practise, may haue some iudgement, &c. But then it must needs bee saide, that hee that hath seene experience and dooth practise, must needs become cunning, according vnto the sharpnesse of his wit, and the valiantnesse of his courage: And furthermore, if one should aske this question, and as it is many times saide, if that such a noble man came in the field, that it is no fighting against him, but if that hee dooth come into the fielde hee shall haue the victorie, and the question is true that it will come so to passe, then what should be the cause thereof? Now it is possible some will alledge one cause, and some another cause, as I haue heard a number of mens opinions, and yet few or none of them the truth: for admit that there may bee two men elected or chosen, so indifferently in all respectes as may bee possible, both in wisdom, stature, age, and man-hood or courage, and in all other matter alike, and that they doo not differ in no respect, and those two men haue been trained vp in seruice in the fielde of long time, and haue seene great experiences in seruice in the fielde, as in sieges, and in being besieged, and in the dooing of other great exploytes, and they haue beene both of them alwaies in those seruices, that if the one hath been there, the other hath beene there



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heere in like manner: but the one in the beginning being a Noble mans sonne, did alwaies serue neare the Generall, or as one in counsell with the Generall, and hath at more yeares of age serued as a General, & the other hath alwayes serued but as a common Souldier, or an inferour officer or Captaine: & admitte the one of them should come into the field, the one against the other of them, and their strength or number of men to be in manner equall: and admit that he that hath the smaller power is the Noble man, there is, no doubt, except great fortune be, but that he that is the Noble man that hath serued as a Generall, shall preuaile and haue the victory, and the cause is this, hee that dooth serue as a General, or hath beene in counsell with the Generall of long time, he doth know how for to prouide and set forth an armie: and contrarywise he that hath serued but as an inferiour Captaine, hath no other care, but to traine his men: the Generall and his counsell, doth foresee where for to lodge and prouide for the armie, and all other necessary matters, and haue their spyalls abroad, and doe know what manner of men be meetest for al maner of purposes, and in like manner doe know what manner of ground is best to encounter with the enemies, and also knowing howe the enemies are prepared, & so accordingly doth order and prepare his battell, to prepare for euery mischiefe that may happen, for that hee hath seene and heard so oftentimes the experience of those matters, whereas those that haue serued as inferiour Captains or Souldiers, haue neuer had any occasion to consi-

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*To the Reader.*

der of those matters, but onely to traine their soldiers & to make them handsom, how to keepe their order, and to handle their weapon: but for any other order of in battelling of themselves, if that they came for to fight in the field, it was alwaies at the discretio of the Generall and his Counsell. And furthermore, admit that in the fighting of a field that they are ouerthrowne, or haue giuen the ouerthrow, the Generall of the army & his Counsell haue perfect intelligence by what means that hath happened, & what thing floode with them, & what thing stood against them, that is to say, if that they that were ouerthrowne had foreseene such a cause, then they had not been ouerthrowne, & also they that did giue the ouerthrow, if that these had not done such a thing they had not preuailed: so that the General & his Counsell dooth perfectly vnderstand of the matter, what was with them, and what was against them, for that they doo heare what hath happened in euery place in the armie, if that it bee worthie of knowing, whereas hee that dooth serue but as an inferiour Captaine, dooth heare nor see no other matter, but those matters that haue happened in his own band, or neare vnto him: and the Generall and his Counsell haue authority to send for, and to examine euery person, that can say any thing in any matter whatsoeuer that it bee, &c. And furthermore, there is a greater matter than this, whereby that those that are the Generals or in counsell neare about the Generall, if that they bee giuen vnto practise and haue good wittes, whereby that they may haue a great deale further instructions and  
knowledge



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knowledge in those affaires, than any other common Captaine or Souldier: which is this: for what is hee that is a Souldier or any other person, but if that he dooth knowe any further matter or skill and secret than any person dooth knowe, but that hee will make meanes to shewe it vnto the Generall, whereby that hee may haue the better rewarde or entertainement; so that you may conclude, that if fortie or fiftie thousand men were in the fiede, that if that there bee any person that haue any knowledge or cunning, but that it will bee vttered and shewed vnto the Generall, then if the Generall bee valiant, liberall and wise, as it is a place for a wise man, there is no doubt but that if hee bee giuen to practise those matters, hee must needes of force become most excellent, for that an infinite number of other mens practises are put into their heades, so that of force they must needes exceede all other men in Martiall affaires, whereas he that is but an inferiour Captaine, although that hee bee giuen vnto practise, can neuer attaine to that which the other hath, for that hee hath not the like instructions in those affaires, not to bee a Generall except great fortune bee. And thus (gentle reader) I doo cease to trouble you any longer, desiring you to beare with my rudenesse, that I should take vpon mee to publish any new Inuentions, and especially in these affayres, considering what a number of wise and valiant Gentlemen and Souldiers, and other learned persons there hee in Englande. And there is no doubt, but that they doo knowe a

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number of better than these, but yet I am assured, although that it will doo them no good, yet it wil doo them no hurte, and it is possible that in the reading of these rude Inuentions, they may finde in some of them, that thing that may pleasure them, and they themselues may further gather of them: for at the first Inuenting of any Arte or Science, yet they that came after them brought it vnto perfection: so that vpon these rude and base Inuentions, that there may bee some further matter gathered of them, and may come vnto perfection, although some of them doo come vnto little purpose, &c. And thus gentle Reader, I desire you to beare with my rudenes, although that I haue written any thing that you may mislike of, for that some of them perhaps may seeme to bee but trifles or toyes, yet it may bee possible that some of them, if that it bee equallie considered of, may doo some pleasure vnto you.

**The**





## The Table of the Contents of the *Deuises, and first for Martiall affayres* by Seas and Ships, &c.

**T**He first Deuise is how for to knowe, whether that anie ship be hier of boorde, than the ship that you are in, and also whether she dooth vnder top you or ouer top you, and to knowe it iustlie a myle before that you doo come at her, &c.

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The 2. Deuise sheweth, how for to arme a ship for to fight with your enemies, &c.

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The 3. Deuise sheweth, how for to vse a plaine or open deck with hatches, that it is not possible to enter the ship without spoyling of the enemies.

Fol. 3.

The 4. Deuise is, what to obserue in the laying of any ship aboard.

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The 6. Deuise sheweth, how for to prenent a man of warre, that he shal not be able to lay you aboard, nor to enter his men with ease, but that ten men shall bee able to keepe out one hundred.

Fol. 5.

The 7. Deuise sheweth, how for to sinke a ship that hath laid you aboard, without shooting of Ordinance.

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The 8. Deuise sheweth, how for to discomfite a whole nauie of ships that doo ride in any place, for the defence thereof, although that you bee not the fourth part of their strength.

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The 9. Deuise sheweth, how for to discomfite an armie of ships by sea, where the principall force dooth stand by one or two ships, &c.

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The 10. Deuise sheweth, how for to encounter with an armie of ships of warre by sea, &c.

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The 11. Deuise sheweth, how for to make prouision that another ship shall not come aboorde of you, to put you in ieopardie of firing, &c. Fol. 8.

The 12. Deuise sheweth, how for to passe by any castle that dooth stand by the mouth of any hauen or harbour, that they must come so neare that they cannot passe, but to be put in ieopardie of sincking, &c. Fol. 9.

The 13. Deuise sheweth, how to preuent him that meaneth to blowe your men ouer boorde when that you haue entred your men, & also by what meanes you may burne & amaze his mē, and to make the ship the easier to be entred, &c. Fol. 9.

The 14. Deuise sheweth, how for to vse a ship that shée shall not sinke, but alwaies swimme and beare sayle, &c. Fol. 10.

The 15. Deuise sheweth, how for to make prouision in a ship for to saue your men from being spoyled with the great Ordinance, &c. Fol. 10. & 11.

The 16. Deuise sheweth, how for to chaine a hauen or riner, although that it be a mile broade ouer, in such sort that no ship shall passe by night nor by day, &c. Fol. 11.

The 17. Deuise sheweth, how for to make a ship to draw or goe but a little way into the water, and yet to saile well by the winde. Fol. 12.

The 18. Deuise sheweth, how for to make a ship or barke in that order, that you may sincke unto the bottome with her when you list, and also how for to make her swimme about the water againe at your pleasure, and being suncke unto the bottome, the men in her to be safe from drowning. Fol. 13. 14.

The 19. Deuise sheweth, how that you may make a boate to goe without oares or saile, &c. Fol. 15.

The 20. Deuise, is as touching a water mill in a boate. Fol. 15.

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The 22. Deuise sheweth, how that you may make ropes fast unto a ship that is suncke, &c. Fol. 17. & 18.

The 23. Deuise sheweth, how for to make such prouision that a man may goe downe unto the bottome of the sea, and remaine there, and make ropes fast unto any thing at his pleasure, and be safe, &c. Fol. 19.

The 24. Deuise sheweth, how to make a Grapnell in such sort, that the more waight it hath, the faster it holdeth. Fo. 20

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The 28. Deuise sheweth, how for to vse a batterie, to shoote both night and day, and to shoote perfectly unto the marke, &c. Fol. 22.

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The 31. Deuise is, how for to vse that peece that is not truly bored, to make a perfect shot. Fol. 24.

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The 34. Denise sheweth, how for to uncloy the touch hole of a peece, if that there bee any spicke or nayles driuen into her. Fol. 26.

The 35. Denise sheweth, how for to carrie a Cannon ouer a riuer or water without any boate. Fol. 27.

The 36. Denise sheweth, how for to knowe, whether that any peece of Ordinance be sufficiently mettalled or not. Fol. 28

The 37. Denise sheweth, how for to knowe whether that a nie peece bee cleere within, and without any hony combs. Fol. 28.

The 38. Denise sheweth, how for to breake any peece of Ordinance with his ordinary charge or loading, and the ordinary shot, &c. Fol. 28. & 29

The 39. Denise sheweth unto you, how if that in the giuing of lenell, that if you doo lay the peece but an inch awry, how for to knowe how much that it will be awry at the marke, &c. Fol. 29.

The 40. Denise sheweth, how if that a citie or towne be besieged, & haue no Ordinance, by what meanes that they may make them Ordinance to defend themselves. &c. Fol. 30.

The 41. Denise sheweth, how to out shoote another person with all one shot, and with one sorte, and one waight of powder. &c. Fol. 31.

The 42. Denise sheweth, how to shoote three times in a peece at one lading of her, &c. Fol. 31. & 32.

The 43. Denise sheweth, how for to make any peece of Ordinance to goe off at any houre or time appoynted, by it selfe, and no person there. Fol. 32.

The 44. Denise sheweth, how for to make a peece goe off when you list, and no person there. Fol. 32. & 33.

The 45. Denise sheweth, how that you shall know whether that any peece of Ordinance bee truly bored, that is to say, whether that the hollownes of the peece be right in the middle of  
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of the mettall, &c.

Fol. 33.

The 46. Denise sheweth, whether the peece bee tapered bored, that is to say, to be wider towards the mouth of the peece than it is at the bottome or breach, &c.

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The 47. Denise sheweth, how that you shall knowe the true thickeesse of the mettall of any peece in euery place.

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The 48. Denise sheweth, how for to know how many inches, or what part of an inch will make a degree in any peece of Ordinance, &c.

Fol. 35. & 36.

The 49. Denise sheweth, how for to leuell a peece in a ship, at any marke or ship, &c.

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The 50. Denise, is as concerning the flancking the front of a batterie, &c.

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The 52. Denise is, as concerning the making of draught or field carriage, to lade them backwards behinde the men.

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The 53. Denise is, as touching a skrewe to coyne a peece of Ordinance, to what leuell you list.

Fol. 38. & 39.

The 54. Denise sheweth, how for to make an engine, for to know the strength or the weakenes of powder.

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The 55. Denise sheweth, how for to make a ball of mettall, and in the time of seruice it doth exceede all other fire workes.

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The 56. Denise is, as touching the making of a truncke for to shoote Caluer or Harquebuzze shot.

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The 57. Denise is, as touching an engine for to take up the side of any peece of Ordinance.

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The 58. Denise is, how to make a charge to lade any peece at one time.

Fol. 42. & 43.

The 59. Denise sheweth, how for to make an engine for to way your powder or your shot, &c.

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The 60. Denise sheweth, how for to ouerthrowe the wall of any Towne, without any shooting of Ordinance, &c.

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The 61. Denise sheweth, how for to breake downe the walls of a towne or castle, or to breake downe strong and huge gates, &c. Fol. 46. & 47.

The 62. Denise sheweth, how for to make a skalling ladder, in such sort, that they that are vppon the ladder shall haue the aduantage of the fight, of them that are vppon the vramers of the walles of any towne or castle, whether that it bee to stand at the push of the pike, or otherwise. Fol. 47. & 48.

The 63. Denise sheweth you, how that you may preuent the undermining of any towne, although that it be a towne situated in a drie place. Fol. 49.

The 64. Denise sheweth you, how that you shall knowe where that underminers be in the ground. Fol. 50.

The 65. Denise sheweth, how for to make away or a vault in the ground to place powder in, to blowe vp any Castle or Fort, or the walles of a towne, and how to make the trayne to giue fire, &c. Fol. 50. 51. & 52.

The 66. Denise sheweth, how for to direct the way in the ground for the undermining of it, to come right vnder any place assigned, which is the principallest poynt in undermining, &c. Fol. 52. & 53.

The 67. Denise sheweth, how if that any Towne haue a breach in a wall, and the batterie is so continued that they cannot make it up, then it doth shewe vnto you how to make it defensible, &c. Fol. 53.

The 68. Denise sheweth you, if that you will cast a ditch out of the ground, and would make a wall or rampier of that stuffe, and you would haue the wall so thicke, then this Denise will shewe vnto you, how bie it will be of that stuffe, and if that you would haue it such a heighth, then you may know in like manner how thicke that it will be of that stuffe, &c. Fol. 53. 54. & 55.

The 69. Denise is, as touching how for to make the trenches for an armie, or the curtens of the walles of any fortifications. Fol. 56.

The 70. Denise sheweth, how for to make the trenches against



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gainst any towne that is besieged, that the people may passe from the Camp & to the Camp, without being spoyled, which is commonly called a rolling trench. Fol. 56. & 57.

The 71. Denise sheweth, by what meanes they may make such prouision to shadowe the place whereas great Ordinance is planted, that the small shot shall not annoy them that are occupied about the great Ordinance, if that it bee vppon such plasformes or places, that there is no baskets to defend them, or to shadowe them. Fol. 57. 58.

The 72. Denise is, as touching the knowing of anything done, or for to be done speedily, &c. Fol. 58. & 59.

The 73. Denise sheweth, how for to conuay letters secretly. Fol. 59.

The 74. Denise sheweth you, how to conuay any great quantitie of letters or bookes, that you would not haue them found, and to conuey them secretly and not to be knowne. Fol. 60.

The 75. Denise sheweth, how that you shall know the minds of your friends, what they will doo, or what that you should doo for them. Fol. 60. 61. 62.

The 76. Denise sheweth you, how that you may send letters vnto your friends, and also receiue letters, although that you be so besieged in a towne or fort, that no man neither come vnto you, nor you passe forth. Fol. 62.

The 77. Denise doth shewe, how many men will stand vpon any peece of ground, they being in their battaile or marching forme, whereby that you may view what number of men that there may be of them, &c. Fol. 62. 63. & 64.

The 78. Denise sheweth, how for to know how many rancks of men will bee in a mile of length, whereby you may by the view of their marching know the number of them. Fol. 64 and 65.

The 79. Denise sheweth, the square roote or number or battell of any number of men. Fol. 65. & 66.

The 80. Denise sheweth, how for to imbattell your selfe square vpon the ground, that is to say, that the ground shall be

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as many foote the one way, as it is the other way, and also there is a table made for that purpose. Fol. 67. 68. & 69.

The 81. Denise sheweth unto you, if that you haue any charge or battell giuen unto the side or flank of the battell, then on the suddaine the side of the battell shall be as strong as the front. Fol. 70.

The 82. Denise sheweth you a way, for to knowe how many men will be in a rancke, and how many ranckes that there shall be of them for any number of men assigned to bee square upon the ground, what space so euer that you would haue betweene man and man, both in length and breadth, and also for to know how many foote of ground squarely they will stand upon or occupie. Fol. 70. 71. 72. & 73.

The 83. Denise sheweth you a way for to knowe this, when that you haue sorted your weapons and knowing the number of weapons of euery sorte, and you would be so many men in a ranck, that doth shew unto you how many ranckes that there will be of them of euery sorte of weapons. Fol. 73. 74.

The 84. Denise sheweth this, if that you are imbattelled, and would take another peece of grounde, which you cannot doe, except that you must passe through a straight, this Denise doth shew unto you, how that you may passe thorow and neuer alter the forme of your battell. Fol. 74. & 75.

The 85. Denise sheweth, howe that you may shift your selfe from one number of men in a ranck, unto another number of men in a ranck, and doe it with ease. Fol. 75. & 76.

The 86. Denise sheweth, if that it were so that in the fore-fronts, if that the men were spoyled either with shot, or by any other misfortune, it doth shew you to supply those rowmes with men presently againe. Fol. 76. & 77.

The 87. Denise is, touching the considerations of things in the ioyning of battels, what things are to be foreseene. Fol. 78. & 79.

The 88. Denise sheweth you, what is to be done if that you are too weake for your enemies. Fol. 79. & 80.

The 89. Denise sheweth you, what places to goe unto for refuge.



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refuge, if that your enemies haue gotten betweene you and home. Fol. 80.

The 90. Denise sheweth, how that you may carrie your match close and not be seene in the night, and also by that meanes you may kepe it from the wet in raynie weather. Fol. 80. & 81.

The 91. Denise sheweth, how you shall know if that it be in the night, if that there be any horsemen stirring, if that the night be neuer so darke. Fol. 81.

The 92. Denise sheweth, how for to trauell by night or by day, in such places that you would not be seene. Fol. 82.

The 93. Denise sheweth, how that an armed man may swim ouer a riuer. Fol. 82.

The 94. Denise sheweth, how that you may make a bridge upon a sodaine, that a whole armie of men, and their cariages may passe ouer any riuer or hauen, if that it bee not of too great a breadth. Fol. 83.

The 95. Denise sheweth, how for to make such prouision, that you may make as many boates in one day, as shalbe able to carry a whole armie of men ouer a hauen or riuer at one time, and of that prouision you shall carry with you, one cart or Wagon shal beare as much of that stuffe, as shal make as many boates, as shall beare 5 or 6. hundred of men at once. Fol. 83. 84. & 85.

The 96. Denise doth shew vnto you how that you may draw your Ordinance before in the front of the armie, and their mouthes forwards ready to be shot off, and the horse behinde the Ordinance, &c. Fol. 85. & 86.

The 97. Denise in like manner doth shew howe for to drawe or drine the Waggon or cartes, and the horse to be behinde. Fol. 86.

The 98. Denise is, as concerning certaine small Ordināce, for to impale an armie. Fol. 86. & 87.

The 99. Denise is, as touching pikemen against horsemen. Fol. 88.

The 100. Denise sheweth, how that you shall know whether that any ground be higher or lower than the ground that you

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doe stand upon.

Fol. 88. & 89.

The 101. Deuise sheweth, how for to know whether that it be possible to bring water vnto any place from the head of any spring, and how hys that it may be raised.

Fol. 89.

The 102. Deuise sheweth, how for to turne a water another way, &c.

Fol. 89. & 90.

The 103. Deuise sheweth vnto you, if that you haue any occasion to lift or wey any thing vp from the ground, and to doe it after colepresse wise, and you knowing the waight of the thing that is to be lifted, and then you may know before hand whether it will lift the thing or not.

Fol. 90. & 91.

The 104. Deuise sheweth, how for to lift any thing with a wheele, and you knowing the waight of that thing that is to be lifted, then you may know what waight will lift it or wey it vp, as the lesse weight will wey the bigger, which is known by the compasse of the wheele, and the compasse of the axeltree.

Fol. 91.

The 105. Deuise sheweth vnto you, if that one wheele doth turne another, then you may knowe if that the one wheele bee turned once about, you may knowe how many times that the other wheele shall bee turned about by the number of teeth.

Fol. 91. 92.

The 106. Deuise sheweth in like manner if one wheele doth turne another without teeth, as with a rope or chaine, then by the turning of the one you may knowe the turning of the other, by the circumference of both the wheeles.

Fol. 92.

The 107. Deuise sheweth, how for to place a glasse in a house or chamber, for to see what things bee abroad in the fieldes.

Fol. 92. 93. & 94.

The 108. Deuise sheweth, how for to make yron, leade, or stone, or any kinde of mettall to swimme, without the ayde of any thing to helpe it, or cause it to swimme.

Fol. 94.

The 109. Deuise sheweth, how it may be possible to burne any thing that is apt to take fire, as gunpowder, Ocum, or Flexe, or pitch, or such other like, halfe a mile, or a mile from you, and to doo it by glasses.

Fol. 95. & 96.

The



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The 110. Deuise sheweth, how it is possible to see a small thing a great distance of, as to reade a letter a quarter of a mile from you, or to see a man foure or fve miles of, and to viewe a towne or castell fixe or seauen miles of, and to see the windowes thereof.

Fol. 96. & 97.

The 111. Deuise sheweth, how to make a crane or engine, that may lift a great weight, as 100. to wey 100000. weight.

Fol. 97. & 98.

The 112. Deuise is as touching the making of engines to thrust from or to pul to you, with great force or strength. Fo. 98.

The 113. Deuise is, as touching the making of strange workes, as the brasen head that did seeme to speake, or birdes of woode or mettall made by Arte to flie, and birdes made of woode or mettall to sing sweetely, at certaine houres appoynted, &c. which the common people dooth maruell at. Fol. 98. 99.

## FINIS.

The Table.

The first Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of Henry the  
first, to the first of Henry the eighth.  
The second Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of Henry the  
eighth, to the first of James the first.  
The third Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of James the  
first, to the first of Charles the first.  
The fourth Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of Charles the  
first, to the first of Charles the second.  
The fifth Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of Charles the  
second, to the first of William the third.  
The sixth Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of William the  
third, to the first of George the first.  
The seventh Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of George the  
first, to the first of George the second.  
The eighth Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of George the  
second, to the first of George the third.  
The ninth Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of George the  
third, to the first of George the fourth.  
The tenth Table, containing the names of the  
Persons who have been created Knights  
of the Bath, from the first of George the  
fourth, to the first of George the fifth.

FINIS





I

*Now shall follow certaine Denises  
as touching Martiall affayres by  
Sea and Shippes.*



First this, whether any Ship be higher or lower of boord than the Ship that you be in, & also whether you do ouer top hir, or vnder top hir; it is very necessarie for him that is a Captaine of a Ship to knowe, for by that meanes there may growe great aduantage, by the knowledge of it, and in like manner great inconuenience by not knowing of it: for when he dooth knowe before that hee dooth lay a Ship aboorde where for to enter his men to the most aduantage, and also it is a great likelihood to doo most good. And this way you shall knowe it most certainelie: stand you vpon the Poope of your owne Ship, and looke you vpon the other Ship, and if you doo see the Horizon circle ouer the top of the Poope of the other Ship, then the Ship that you are in, is higher of boorde than the other Ship, but if you doo see any parte of the other Ship higher than the line of the Horizon, then that part of the other Ship is higher of boorde than your Ship, by so much as you doo see aboue the line of the Horizon, for this is generall for euer, looke whatsoeuer you do see euen with the Horizon, is iust in height equall with your eye, neither higher nor lower. so that by this meanes you may know what height any Ship is in euerie place, comparing hir by your Ship, as this. If your owne

B

Ship

Ship be higher than the other Ship, then goe you lower in your owne Ship, vntill such time as you doo see that part of the Ship euen with the Horizon, and then looke vpon your owne Ship, and marke where the Horizon cutteth, then that part of your Ship is iust equal in heighth with the other, & by this meanes you may view any Ship in euery place at your pleasure: and then to knowe whether the other Ship dooth ouertop you, or vnder top you, either goe vp your selfe, or send vp vpon the shroudes, and then where you doo see the top of the other Ship iust with the Horizon, then your eye is in heighth iust with the other Ships top, whether you be vnder or ouer the top of your owne Ship, and this is true without any fayle, as I doo further shew in the first Booke of the *Treasure for Trauellers*, the 8. Chapter.

*The 2. Denise.*

**A**S touching this, how to arme a Ship of warre, to fight with another Ship or Ships, this must be considered, that you keepe your men as close as you may, for beeing spoyled with small shot, or Quarrels, & Arrowes: wherefore you must haue a bonnet of a sayle, or else some other Canuesse stretched and made fast all alongst the wast and deckes of the Ship, and also to arme the forecastell & the Poupe with Mantels or gownes and such other like, to shaddow your men, and then in like manner your tops to be armed, to shadow your men: but now in these daies, the topfight is vnto little effect, since the vse of Caliuers or Muskets in Ships; for a man may arme the top for the Quarrels or Arrowes, but it is not possible to arme it against the Caliuers: wherefore it is not good to haue many men in the tops in these dayes, for they will be but spoyle. And also, you must catharp your shroudes, and also to haue a netting to goe with chaynes in your wast, & in like manner



## *and strange Deuises.*

3

manner abast your maine shroudes, according to the building and contriuing of the Ship, and then you must appoynt your small shot to stand at the loupes, & such other like places, to beate at your enemies: in like manner the Gunners to vse their great Ordinance, & so consequently euery person to look to his charge that the Captaine hath appoynted him to doo.

And also, the Captaine must appoynt the Carpenter to goe into the holde of the Ship, with such prouision as is meet for the purpose, to stop any leake if any chance. And also, to send downe the Surgion into his Caben, which ought and must be in the holde of the Ship, and he for to haue all such prouisions as is meete for his purpose in a readinesse, to the end to dresse the hurt men. And these things ought the Captaine of any Ship to foresee aforehand, with diuers other causes, as the things it all require, which I for breuitie doo omitte.

### *The 3. Deuise.*

**A**Nd furthermore, you may make a plaine Decke or Orloppe, that hath but plaine hatches, and hath no other fight, that it shall be in manner vnpossible to win the Ship, without the sinking or spoyling of the Ship, as this, to take vp two of the hatches, one before, and another abaste, as you shall see it most conuenient for your purpose, and at the corner of the hatch make a hole with an Auger, so that at the foure corners of the hatch there bee foure holes, and so right against euery hole, when the hatch is laide, bore it with that Auger downe thorough the comings and the beames and all at the foure corners, and then take a peece of wood of a seauen or eyght ynches long, and three or foure ynches thicke, whether it bee rounde or square it is all one matter, and then bore a hole with the Auger thorough the little peece of wood,

B 2

thorough

thorough the middle, beginning at the one end, and out at the other ende, and so to haue for euery corner of the hatch, a bolte of yron, with a good broade head, and to be of length to goe through the hatch, the chookes of wodde endlong, and the comings of the hatch and beame, and all that it may bee afore locked vnderneath, and this to vse two of the hatches, and then when you doo see cause, you being a Merchant man, that any Ship dooth assaile you, then set vp the two hatches in the Ship, and looke that the boltes be sure locked vnderneath the Decke, and then these hatches will lie seauen or eyght ynches higher than the rest, so by that meanes there can no man come vppon the Decke, but that they may either lanch a Pike at him, or shoote a Calyuer, or vse a Crossebowe, or drawe a long bowe, and so generally there is no weapon, but that they may vse at them rounde aboute the hatch, that it is not possible to bee vnspoyled vpon the Decke, and being two hatches, vsed thus, the one hatch shall cleare the other. And this deuise is a hundred times better than the Spardeckes, &c.

*The 4. Deuise.*

**A**S touching the laying of any Ship aboarde. If your Ship bee higher of boorde than the other Ship, then view hir where that the best place is for to enter hir, that is to say, where shee hath least force against you to defend hirselfe, & where your men may enter with most ease: & of that the other Ship be higher of boord than your Ship, the you must lay hir aboard, that you may come vnto the cheyne walles to enter by þ shrouds, either þ fore shrouds, or the mayne shrouds, &c. And furthermore, this must be most principally obserued, if you haue any cōfort or comforts of any other Shippe, or Shippes, that dooth come to helpe you, or you come to helpe them, that you doo not lay



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lay them aboard the one vppon the one side, and the other vppon the other side, for then the one of you shall doo the other of you hurt, ten times more than the enemies, both with your great Ordinance, and also with your small shot, and your owne Quarrels, and Arrowes: wherefore if that the other Ship be aboard already alongst the side, then if that you cannot haue room to lay him aboord on that side, then lay him aboard athwart the Stemme, or athwart the Stearne, as you shall see to your most aduantage, but in any wise come not aboard on the other side, for then you shall spoyle your selfe, & your consort in like manner.

### *The 5. Deuise.*

**I**F so be any Ship hath layd you aboard, and that you are too weake for him, then if so bee that you doo see the winde and the tide to bee all as one, or if that it bee calme, then vppon a suddaine put downe an Anker, and then as soone as euer your Ship doth ride, then the tide will carrie the other Ship away from you, and then if that the winde and the tide be all one, it is not possible for the other Ship to come neere you againe, nor vntill the tide doth turne, to come vnto the windward againe.

### *The 6. Deuise.*

**A**N D if any Ship doo giue you chase, and you do know that you are too weake for him, and also, although he sayleth better than your Shippe, then when he doth come neere vnto you, and there is no remedie but he must needs lay you aboord, then goe you hence afore the winde betwene your two sheetes, and then as the other Ship dooth fetch vpon you, and bee readie to lay you aboard, alwaies keepe your Stearne vnto him, and suffer him not to come vp by your side, so shall you driue them to enter at your

Stearne ouer your Poop, and then they shal enter so painfully, for that they must clamber vp by their owne Ships boulespret, such a narrowe place as the Stearne is, that a fewe men shall bee able to keepe them out, and this you may doo with ease, as long as you haue roome to goe afore the winde, that hee shall neuer bee able to lay you aboard, but onely at your Stearne, so that the Steeradge be well looked vnto, for as soone as you doo see him preace to come vp by your side, then louffe you from him, and so by this meanes he shall not bee able to come neere any other place but your Stearne, &c.

### *The 7. Deuise.*

If any Shippe hath layd you aboard about your bowes, and if you would sincke him, then let your Ancker next vnto him hang a Cockbell with a strong Painter, or rope, that the crossie or Floukes may hang a little vnderneath the water, and then by the meanes of the heauing and setting of both the Shippes with the Sea, the Ancker will rent or plucke out the plancke of the Ships side with Ancker Floukes, and yet it will doo your owne Shippe no great hurt, for that still the Ancker hangeth leuell but at one heigth, and the most hurt that it may doo vnto your own Shippe, it will pike but a hole, but for the other Shippe, she falleth downe vppon it with her whole weight a fadome long together, which must needs with two or three plunges rent out the plancke of the ships side, &c.

### *The 8. Deuise.*

If that an armie of Shippes doo ride in any Haven or Riuer to defend any place, or to keepe any place for receiuing of any more strength or vittakes, & that they meane to ride there still, and haue placed themselues in such order,



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der, that no ship may passe by them, either to man a place, or to vittaille that place, thus it may be done: first this, prepare such a sufficient number of bad or olde ships as shall be conuenient, and then put such kind of stufte into them as will quickly bee fiered, and then when you doo see conuenient time that the winde and tide dooth serue your turne, send those olde ships before with a few e men for to gouerne them vnder saile, and with boates to saue themselves, and then let them a little before set them on fire, and lay the principall ships aboard crosse their Halce or Stemme, and then there is no doubt but they shall driue them to let slip their Anckers, or consume them with fire, and then the moe men that there bee in number aboard, the greater shalbe their terror, if that they haue not boates enough to saue themselves, and then presently after that, you may come in, and doo your exployte, for that they will bee in such a maze with the fire, that you may doo what you list: for if this deuise had been put in practise by Countie *Mongomery* when he went vnto *Rockell*, there is no doubt but they had both discomfited, or spoyled all those ships that did ride before *Rochel*, and also the Count *Mongomery* might haue landed at his pleasure.

### *The 9. Deuise.*

**W**Here there is any Fleete that doth passe through the Sea, that dooth carrie either some principall person of estate, or els some great quantitie of treasure or other riches, and haue certaine ships of great force to waite them, and to doo such an exployte, to come by the spoyle of the, it may be thus handled, if it be not disclosed: the secrets of the matter is this. Get some great ships of countenance that are but bad, & let them seeme to be the Admirall, & to encounter with their Admirall or principal ships of force, & then when that they be aboard, to set the on fire, hauing  
such

such things aboard as will burne with great terror: and this will set a Ship on fire very suddainly, set a great Cawderne of Pitch or Tarre vpon the fire, and make a great fire vnder it, and then let all the tackle about the head be newly tarred, and also haue such things neere, as will take fire presently, and then whilst you are aboard of them, set fire on it, and it will be at the top on a suddaine, and so shall you consume both the Ships with fire, and the men in your Ship are already prepared to saue themselves with their boates: then the other Ships may followe the spoyle or chace at their pleasure, and then when they do see their chiefeest force taken from them, then they will be discouraged presently.

*The 10. Deuise.*

**T**He principallest matter for to encounter with an armie of Shippes by Sea, is, to haue the weathergage of them for diuers causes, and for that those causes are not vnknown vnto most men, I do cease for the saying of any thing therein: and in like manner neuer goe about two Shippes in a ranke, for if you doo, the one shall annoy the other of them, and the closer you doo enforce your enemies, the more aduantage you shall haue of them, for one shall hinder or hurt another of them.

*The 11. Deuise.*

**I**F you haue any great principall Ship of great force of Ordinance, and for feare of those Deuises before spoken of, least any Ship doo come aboard, to put you in danger of fiering, then it is best to prepare certaine strong Masts for to put out at the ports round about the Shippe, and to haue peeces framed with boults without boord, twentie or thirtie foote from the Ship, from one Mast vnto another, that



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that no Ship may come betweene them, and those framed Mafts may lie within boord, vntill such time as occasion shall be to vse them, and to take them in, and put them out at their pleasure, as need of seruice doth require.

### *The 12. Deuise.*

**I**F it happen so that there bee any place where there is an exploit to be done, as the ayding of any place either with men, or vittailles, or such other like, and there is Ordinance so placed at the entrance, that it seemeth not possible to passe it, for that the Channell commeth so neere vnto the Ordinance, yet by this meanes at a suddaine it is possible for a whole Flecte to passe, as this. Prepare two or three old great shippes more or lesse, according vnto the discretion of them that haue viewed the place, where the Ordinance is that you do meane to passe with your flecte, then seeing your time conuenient, run aground with those olde Ships right in the face of the Ordinance, with their sayles standing, and then they will shaddow with their holds and sayles all the rest of the flecte, till such time as they shall be past the principall danger of the Ordinance.

### *The 13. Deuise.*

**I**F you haue laide any Ship aboard, and you doo perceiue that he hath made a traine, to the intent that when you haue entred your men, to blowe them ouer boord, to preuent that, doo this: first prepare certaine earthen pots made of purpose, that will holde two or three pounce of powder more or lesse at your discretion, and that the pot haue three or foure little eares round about the side, that you may make a little peece of match fast thereunto vpon euery side of the pot, which being filled with powder, and the mouth of the pot beeing stopped, and the peeces of  
C match

match set on fire, then where you doo perceiue that the traine is made, there throwe in of these pots, and then the fall of the pot will breake the pot, and so the match that hangeth by the pot side, will set the powder on fire, and so set fire on their traine, &c. And also these pots be very necessarie to be throwne whereas men doo stand thicke, for to burne them, and to amaze them with the powder. And also of these pots they may throwe into the place of the chiefest fights of the shippes, to amaze the men, and so by that meanes they may the easilier enter the ship. &c.

*The 14. Deuise.*

**T**O cause a ship that she shall not sincke: first let her be sufficiently ballested, and then prepare as many caskes as halfe the shippes burthen commeth vnto, and let all the caskes bee made close and tight, that no water may come into them, & then the caske being layd close vnto the ballest, and fraped down close, that it doth not stirre, then the ship will not sincke for any leake, for the caske will make her swim, and the ballest will make her beare saile. The like may bee done by making close of the hatches, so that the Orlop be vnder the water, so that the sperkets be tight.

*The 15. Deuise.*

**A**Nd furthermore, for to make prouision in a ship that your men bee not spoyled with great Ordinance, and especially to preuent the haile shot, and Crossebarre shot, or cheyne shot, and yet your men to stand in a readinesse at all times, then doo this: first prepare Elmen planckes of 4. or 5. or 6. ynches thicke, or any other plancke of such wood as will not rent or splenter, and then in such a convenient place vnder the Decke, let it be strongly stanshioned all alongst the middle of the ship with two rowes of  
stantions,



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II

stantions, and to bee of 4. or 5. foote asunder betweene the two rowes of stantions, and that will bee like the case in a Galley that the Canon lieth in, and then that done, throw all the old ropes you can get, and fill that full therewith, and then when you are in fight with your enemies, looke of what side he is of you, then those men that are not occupied, either about the Ordinance or the tackling of the Ship sailes, may go vnto the further side of those plancks, and be safe from the violence or spoiling of them with the shot, for the ropes that are within the case, wil kill the violence of the shot, and especially the Crossebarre shot, or cheyne shot, which is the chiefeest spoyling of men, and yet notwithstanding the men are in a readinesse whensoever you haue any occasion to vse them, whether it be to enter the other Ship, or to defend that Ship which you are in.

### *The 16. Deuise.*

FOR the preuention of the 8. Deuise, that is to say, to let them that should passe by any Bulwarke or platforme, they must cheyne their Hauen or harborrow, if it be of any great breadth, then it must bee done in this manner: for that the cheyne is of such great weight, that it is almost vnpossible to make any engines to stretch or wey the Cheyne aboue the water, therefore when the cheyne is laid crosse the water, they must prepare certaine great Lighters made of purpose, with certaine engines, as Capstines, or Geares, or such other like deuises, to wey the cheyne aboue the water, and so to let the Lighter ride by the said cheyne at all times, and when they would haue Shippes to passe too and fro, then the Cheyne may be suncke to the bottome, and when that they would haue no Shippes passe, then the Lighters may wey the Cheynes. Being neere vnto any place, whereas Ordinance is planted, it is not possible to passe in. And by this meanes they maye cheyne a

harborough that is a mi'e broade ouer, hauing Lighters sufficient enough to wey the cheyne aboue the water. And also by this deuise, they may stop any passage vpon a suddaine, although they haue no cheyne, when it is so darke, that the watch of any Castle or Bulwarke cannot see them to make fast some great Cabell crosse the water, and to vnder-run the sayd Cabell with boates.

*The 17. Deuise.*

FOR to make a Ship to drawe or goe but little into the water, and to hold a good winde, and to saile well both by and large, were very necessarie, and especially in these our shallowe Seas, amongst such a number of sands and banckes, and as I haue shewed in my third Booke, called *A Treasure for Travellers*, the 6. and 7. Chapter, how to alter the bignesse of Shippes, and to keepe that molde and proportion in all poynts. Wherefore if you would haue a Shippe to drawe but a little water, and to saile well by the winde, then doo this, she must haue a flat bottome, like as the Binelanders and Plaites haue on the other side of the Sea in *Flanders*, and as I haue shewed in the 9. Chapter in my booke before mentioned, that all Ships that bee flatie, will saile well with the winde: but now to make it to saile well by the winde, then doo this. That place where as the Keele should stande, must bee open into the Shippe, and made tight on both the sides, as high or deepe as the Ship dooth goe into the water when shee is loden, and in that there must be made a thing to be letten downe, and to bee wound vp againe as neede shall require, which thing must bee in this manner, to bee as long as almost the length of the Keele, and to bee well plancked and made strong, according vnto the bignesse of the Shippe, and to bee beaten downe into the water foure or fve foote, according vnto the quantitie of the Ship, and then when you would haue



haue it to hold a good winde, cause that to bee let downe into the water, and then that will not suffer the Ship to fall to Leewardes: and then when that the winde is large, and that you are to passe any shallowe water, it may bee wound vp againe, and by this meanes you may make a Ship of a hundred Tunnes not to drawe fiue foote water, hauing length and breadth correspondent to beare the tonnage.

*The 18. Deuise.*

AND also it is possible to make a Ship or a Boate that may goe vnder the water vnto the bottome, and so to come vp againe at your pleasure, as this, as I haue declared in my Booke called *The Treasure for trauellers*, in the 4. Booke called *Staticke*, that any thing that sinketh, is heavier than the proportion of so much water, and if it bee lighter than the magnitude of so much water, then it swimmeth or appeareth aboue the water, according vnto the proportion of weight, and then this being true, as it is most certaine, then any magnitude or body that is in the water, if that the quantity in bignesse, hauing alwaies but one weight, may bee made bigger or lesser, then it shall swimme when you would, and sinke when you list: and for to make any thing doo so, then in the ioyntes or places that doo make the thing bigger and lesser, must be of leather, and in the inside to haue Skrewes to winde it in and also out againe: and for to haue it sinke, they must winde it in to make the thing lesse, and then it sinketh vnto the bottome: and to haue it swimme, then to winde the sides out againe, to make the thing bigger, and it will swimme, according vnto the body of the thing in the water. And to make a small Ship or Barke or Boate, do this, the Barke being made of purpose, let there be good store of Balest in the bottome of hir, and ouer the Balest as lowe as may

be, let there be a close Orloppe, such a one, that no water may come into it, and then in like manner at a sufficient heighth, to haue another close Orlop that no water may come through it, and that being done, then bore both the sides full of holes betweene the two close Orlops: and that being done, then make a thing like the side of the Barke or Ship that may goe vnto the side of the Ship, the one for the one side, and the other for the other side, and that must be made so tight and close, that no water may come thorough it, and that done, then take leather, such a quantitie as is sufficient for to serue your purpose, and that leather must bee nayled close, with such prouision, that no water may soake thorough it, and to be of that largenesse, that the thing may goe close vnto the Barke or Ship side when you would, and come in againe, to let sufficient water in, that it shall not be able to swimme. And now this being done, then you must make prouision of Skrewes or other engines, to winde the two things on the insides of the Barke or Ships, that you may winde them in or out at your pleasure and that done, then for the hatch or Skotel, that you must goe in or out, you must haue leather round about it, that you may bring that together as a pursse mouth, and so with a small Skrewe, you may winde it so close together, that being in the bottome of the water, there shal no water come in, and that done, then you must haue one Mast, that must bee of such sufficient bignesse, that it must haue a hole bored thorough the one end vnto the other, as a Pompe hath: and that done, then when that you list to sinke, then you must sound the deepenesse of the water, and foresee that the water will not rise higher than the top of the Mast, for the hole that goeth thorough the Mast must giue you ayre, as man cannot liue without it: & now when you would sinke, then with your Skrewes winde the two sides inwards, and water will come into the holes, and so the Ship or Barke will sinke vnto the bottome,



## *and strange Deuises.*

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come, and there it may rest at your pleasure: and then when that you would haue it swimme, then with the Skrewes winde out the things on both the sides, and that will thrust the water out againe at the holes, and so it will rise and come vp about the water, and swimme as it did before, &c.

### *The 19. Deuise.*

**A**Nd furthermore, you may make a Boate to goe without oares or Sayle, by the placing of certaine wheelles on the outside of the Boate, in that sort, that the armes of the wheelles may goe into the water, and so turning the wheelles by some prouision, and so the wheelles shall make the Boate to goe.

### *The 20. Deuise.*

**A**Nd also, they make a water Mill in a Boate, for when that it rideth at an Anker, the tyde or streame will turne the wheelles with great force, and these Milles are vsed in *France, &c.*

### *The 21. Deuise.*

**A**Nd in like manner, they may make an engine to know the way or going of a Ship, for to knowe how fast or softly that any Ship goeth, which is very necessarie for al them that goeth of long voyages, in a number of causes. The instrument is to be made in this manner. There must be made a little small Boate, and then there must bee placed a wheelle in the Boate, that the armes thereof must goe in the water, and so as the Ship passeth or goeth in the Sea, so the way of the Ship doth turne the wheelle by the armes that goeth in the water of the Sea, and from  
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that wheele or wheelles that goeth on the outside of the little Boate, there commeth an Axeltree. & vpon that there is a note, with fixe or eight teeth more or lesse, as the deuifer or maker shall see good, and that note shall turne another wheele by the teeth, on the Circumference: and the wheele worke may bee so framed or pitched, that when the wheele on the outside of the little Boate hath gone 50. or 100. times about, that the note on the Axeltree shall turne the inner wheele but once about, and then the thing being tryed, that when the wheele with armes that goeth in the water, hath gone once about, that the Ship hath gone so many foote or ynches iustly, and then when the wheele on the outside hath gone such a number of times about, then the inner wheele is turned once about, and then it may be faide, that the Ship hath gone so much, when the wheele is turned once: and then that wheele shall haue a note vpon the Axeltree thereof, and turne another wheele by the teeth of the Circumference, and so you may make one wheele turne another, and to haue so many motions, that the last wheele shall not bee turned about, vntill the Ship hath gone 500. or 1000. leagues. As for example this. The wheele that goeth on the outside of the little Boate, when that it is turned round once, the Ship hath gone iust fixe foote, that is, one Fadome, and now the note that goeth on the Axeltree, dooth turne a wheele by the teeth, in such sort, that when the outward wheele hath gone 100. times about, that it is turned once, and then you may conclude, that when the first wheele on the inside of the Boate hath gone once about, that the Ship hath gone 600 foote, or 100. Fadomes: and now this first wheele dooth turne another wheele in the like order, that is, for 100. turning, to turne the other but once, & then you may conclude, that the Ship hath gone 100. times 100. Fadome, and that maketh 10000. Fadomes, and that conteineth foure leagues, and then there is



is an Axeltree on that wheele with a nut that turneth a third wheele by the teeth on the Circumference, in that order as before is shewed, that when the second wheele is turned 100. times about, that the wheele is turned once, and then you may conclude, that when the third wheele is turned once about, that the Ship hath gone 100. times foure leagues, that is 4000. leagues. And by this order, this engine or instrument shall shew vnto you how much the Ship hath gone, by the turning of the wheeles. And to see and know how the wheeles dooth turne, then there must bee made certaine spurres, such as the hand or the poynters of the dyalles of a Clocke hath, to come from euery wheele, and so to be marked round about, in such order as the dyalles haue for the houre of the day, but those diuisions may bee diuided but into eyght partes or sixteene partes, and so the directer that commeth from the first wheele, will shewe in his turnings the number of Fadomes, and the second wheele will shew the number of leagues, and the third wheele may shew you the number of skores of leagues, and so to haue another to shewe the number of 100. leagues, and so forth at your pleasure you may make as many motions in it as you list, as it shall be most meetest for the purpose, & best for continuance. And this instrument being towed in a little small close Boate, will shewe vnto you the way of any Ship, that is to say, how fast or softly that the Ship goeth thorough the water, &c. The deuiser of this engine or instrument was *Humfrey Cole.*

*The 22. Deuise.*

**A**S I haue declared in the fourth part of my Booke called *A Treasure for Travellers*, how to wey sunken Ships, so in like manner I doo thinke it good to shewe how to make their ropes fast vnto any suncke Ship, if it bee

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suncke very deepe in the water that they may come by no part thereof at a lowe water, then it is very tedious and difficulte to make any ropes fast vnto it, for that no man may come at it to make any ropes fast vnto any strong place thereof: yet the *Venetians* and the *Italians* doo vse to diue vnder the water, which we here in *England* cannot doo for two causes. First, our Countrey is more colder than theirs. And secondly, their Sea water is more clearer than ours for two respects, for their water dooth not ebbe and flowe as ours dooth, so that the wash of their Sea is alwaies in one place, and our water dooth rise and fall, and the water sometime beateth in one place, and sometimes in another place, which dooth cause our water to bee alwaies thick, and in like manner by the meanes of the ebbing and flowing, it causeth a tide or streame to run too and fro, which will not suffer the water to be cleare, and so foorth.

And also, the *Venetians* and *Italians* haue (when that they doo diue vnder the water) a place of refuge to take ayre or breath in, by some great vessell of mettall of sufficient bignesse, and of weight, and let it downe vnto the bottome, with the bottome of the vessell directly vppwardes, so standing vppon three or foure feete vppon the ground in the bottome of the Sea, and being letten precisely downe with the bottome vppwardes, it is full of ayre, and then when that they cannot holde their breath no longer, then they doo repayre vnto the saide vessell, the feete thereof being so high, that they may goe easilie vnder it, and there vnder the vessell they doo breath themselves in the ayre in the bottome of the Sea, &c. But Englishmen be not vsed to doo that: wherefore in my opinion, this is a very good way, that Englishmen may vse to make their ropes fast vnto any soncken Ship or vessell at a still water, that is to say, at a lowe water, or a full Sea in the night, to prepare certaine Glasses being



being made of purpose, to bee tyght, that water cannot get in, and to put lightes or Candles into them, and then let them downe whereas the soncken Ship is, so shall they see how for to take the best holde of the Ship, and then hauing prepared their Grathels and their engynes, they may catch holde of the suncken Ship at their pleasure, for you may see any light thorough the water, and also any thing that is neere vnto the lighte. &c.

*The 23. Deuise.*

**A**ND furthermore, they may make such prouision that any man may goe downe vnto the bottome of the water, and remaine there at his pleasure, as this: first prepare leather, and make a case of it in this manner. First for his head, and that must bee made large ynough, and then there must bee two holes for his eyes, and then set in Glasse, and make it tight round aboutes it, and so make the body and the sleeues for his armes, and to bee closed so close, that no water may come into it. And that done, then there must bee a long Truncke made of Leather that must bee hollowe within, that must bee longer than the deepenesse of the water, and that must bee tighte too, and then at the vppermost ende or top there must bee a bowle, or such a thing that will swimme, that through the Truncke that is like a rope, the ayre may passe downe vnto him that is in the bottome of the water, and so the man that is put into the case of Leather, and that beeing made tyght, that no water may come in vnto him, and especiallie vnto his Mouth and Nose, and so to haue ayre to come downe thorough the Trunck of leather, then he hauing sight thorough the Glasse, hee shall bee able to endure to tarrie in the water, and also to see in the water how for

to make ropes fast vnto any thing that is sonke in the water, &c.

*The 24. Deuise.*

**A**Nd also for the making of a Grapnell, that shall holde fast any thing it hapneth to take holde of, it must bee in this manner, that is to say, that it must be made of good yron, and very substantiall and strong, of two peeces, to goe vpon a very strong pin, that the ioynte may goe too and fro, and then the end that must take holde, the endes must be turned inwards, like as a paire of Pincers dooth, and then aboue the ioynt or pinne, then the ropes must bee made fast thereunto vpon both the cheekes or endes thereof; and that done, the more weight that this kinde of Grapnell taketh holde of, the faster it keepeth it, by the meanes that the ropes vpon the vpper end by the meanes of the weight, dooth drawe it togetherwards, so by that meanes the thing that it hath taken holde of cannot slippe from it, &c.

*The 25. Deuise.*

**I**F any Ship haue a leake in hir, and will not be found, for that you cannot see where the water dooth come in, then take an earthen pot, and leaue nothing in the pot, and then a boordes ende, and set the mouth of the pot vpon the boordes ende, with the pot vpon it in the holde of the Ship, and then lay your eare, and hearken vnto the pot, and if you be neere vnto the leake, you shall heare the running in of the water, and the neerer you doo come, the more breefer you shall heare it, and the farther off you bee, the lesse you shall heare it, so by the remouing of it too and fro, you shall heare in what place it is in the Ship, &c.



The 26. Deuise.

**A**Nd if a Ship haue her Masts standing, and neuer a rope fast vnto the top of it, and for to get vp vnto the toppe thereof, then this he must doo, they must first prepare eyther a greene strong withie, & for that the Mast is smooth, then there must bee made a certaine number of things of yron, with a hole through them as a beauestone hath, or as the Trockes for the parrell of a Mast, but they must bee three cornered and sharpe, that it may take holde of the wood, and not slip, and then they being put on the withie, or such other like, then let that part that is about the mast, haue those triangles of yron, and the other part to goe about the bodie of him that doth goe vp the Mast, in such forme, that it may bee so slacke, that hee may set his feete vpon the Mast with ease, and so hee setting his feete vpon the Mast, and leaning backwards, shall raise himselfe, and when that his feete is as high as he can, then he must giue his bodie in, and then iam or lift the withie vp higher with his handes at a suddaine, and so by that meanes he may get vnto the top of the Mast, for in leaning backwardes, and the harder that hee leaneth, he causeth that things that are about the Mast, that they will not slippe. &c. And by this order, the *Neagers* in *Ginny* doo vse to goe vp vnto the top of a tree, and if that it were 60. or 70. foote high without a bough. And if that the Mast haue Trefeltries at the top thereof, then they may doo this, to make a small line fast vnto an arrowe, and so to shoote it ouer the toppe of the Mast, and then with the small line or string you may drawe vp a bigger, and so still from the lesse vnto the bigger, vntil that you haue such a one vp as will serue your turne to goe vp by. &c.

*The 27. Deuise.*

**A**S touching the keeping of a Hauen or Riuer by night, in such sort, that you would haue no shippe nor other vessell to passe, neither by day nor by night, then you must deuise some imagined marke or markes vpon the farther side of the water, & then you must plant your Ordinance right vppon those markes, and then in the night you must place lights in those places, and then if that there dooth come any Ships in the night, they will shaddowe or take away the sight of the light from you, and then you may be assured, that the ship is right with the mouth of the peece, and then you shooting off your peece, you shal hit the ship if that it bee discretely handled, as I doo more at large declare in the 26. Chapter of my booke, called, *The Arte of shooting in great Ordinance.*

*The 28. Deuise.*

**F**OR to continue a batterie both night and day, you must doo this: when that all your Ordinance bee laden and leuelled vnto the breach or markes assigned, and would continue the same day & night, then take your Quadrant, and looke at what degree that the peece lieth, and then plome the middle of the mouth of the peece downe vnto the ground, and there make a marke, and then plome the middle of the taile of the peece down vnto the ground, and there in like manner make another marke, and then drawe a right line from both the markes, and the line to be longer by two yards, than the two marks, and that done, you may continue to shoote all the night, for the degrees in the Quadrant will giue the peece the true height of the marke, and the line vnderneath the peece will lay the peece right vpon the marke, as I doo more at large declare  
in



## and strange Denises.

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in the 24. Chapter of my booke, called, *The Arte of shooting in great Ordinance.*

### *The 29. Denise.*

**F**Or to plant Ordinance in the night, and to shoote presently at any marke assigned, doo this. First, seeke the ground meete for your purpose, and then take an Astrolobe, and hang that vppon your thombe by the ring, and then turne the Athilleyday or rule with the sights vp and downe, vntill that you doo see the marke that you doo meane for to shoote at through both the sights of the Athilleyday, the Astrolobe for to hang perfutely vpright, and then looke vppon the Astrolobe at what degree that the Athilleyday dooth poynt vnto, and keepe that in remembrance, for that giueth the peece the true heighth of the mark, and then where that you doo meane for to plant your Ordinance, there make a marke, and then goe backwards twentie foote, and then view the marke that you do meane for to shoote at, that it be right ouer the marke that you haue made vppon the grounde, and right with that marke make another marke, and then goe a little further backwards, and then view it againe, and see that the mark that you doo meane for to shoote at, and the other two markes that you haue made vppon the ground, to bee all three vpon one right line by the the sight of your eye, and if that they bee not, then you may amende them, and set them right, and then those two markes will rule the matter, so that you may lay the peece right vpon the marke, and then you bringing your Ordinance in the night, you may shoote presently, as I doo more at large declare in the 25. Chapter of my booke, called, *The Arte of shooting in great Ordinance.*

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*The 30. Deuise.*

**A**S touching how to shoote at a Ship that is vnder saile in a Riuer, they must doo this, they must plant their Ordinance against some ymagined marke, vppon the farther side of the water, and then when that they do see that the ship doth begin to close the ymagined mark that their Ordinance lieth right against, then giue fire vnto the Ordinance, and they shall make a perfite shot, as I doo more at large declare in the 14. Chapter of my booke, called, *The Arte of shooting in great Ordinance.*

*The 31. Deuise.*

**I**F that you haue a peece of Ordinance that is not truly bored, that is to say, if the core or concauitie doo not goe right in the middle of the mettall, but that it dooth leane more the one way than it dooth the other way, that peece will neuer shoote right vpon the marke, except they doo this: looke toward which side the mettall of the peece is most thickest, vnto that side the peece will cast the shot, and for remedie thereof they must do this. First they must seeke where the mettall is most thickest, and that beeing knowne, then when that you doo set vp the dispart of the peece, you must put halfe the diuersitie of the thickest of the mettall, that it is thicker on the one side more than it is on the other side, vnto the length of the dispart, and then you must set the dispart iustly vppon that side and place that the mettall is most thickest, and then when you doo make any shot with that peece, you must giue your leuell iustly vppon the thicker side of the peece, that is to say, the mettall of the breech of the peece, and the dispart, and the marke, to bee all three vppon one right line by the sight of your eye, as I doo more plainly shewe in the 12.



Chapter of my booke, called, *The Arte of shooting in great Ordinance.*

*The 32. Deuise.*

**I**F that any place be to be besieged that standeth vppon a marish ground, so that it is thought vnpossible for to bring the Cannon vnto it, yet notwithstanding it is possible by this deuise both for to bring the Cannon vnto it, and also for to place the Cannon against it, although that the ground be neuer so soft. First, let them prepare a flat bottomed boate for euery Cannon, & if that it were a Cannon of 8000. weight, the boate but 20. foote long, and 8. foote broad, if that boate were in the water, the boate will swim with that Cannon at one foot deepnesse going into the water, then it is a plain case whether that it be marish ground or owes, it will not sinke halfe so much to be drawne ouer it, being in the boate, and the boate to be made tight, that no water or durt doo come in: and then if that the ground be so soft, that they can bring no horses to make the drawe it, yet it may be drawne by men, and 80. men will draw it, and if euery man do draw but 100. weight, the boate to be made at that end that goeth forwards flat long, that it may strike against nothing. And I am of that opinion, that it is not possible to make any better kinde of platforme to place their Ordinance vpon in the boate, for if the ground were neuer so soft, it can sinke no further into it, nor so far neither, as it will into the water. And by this meanes they may both bring their Ordinance, and place their Ordinance in any ground how soft so euer it be, at their pleasure.

*The 33. Deuise.*

**I**F that it hapneth so that you haue any peece of Ordinance, which when you haue laden her, the shot will not

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goe home vnto the powder, and that the peece is so cloyed, that if the peece bee shot off, shée will breake: to saue the peece, and vncloy the peece, doo this: for if that it were in any place of seruice, if the peece doo breake, there may happen three great daungers, as this. First, the lacke of the thing when they should vse it. And secondly, the losse of the value of the thing. And thirdly, the hurt that may happen by that meanes. &c. And for to vncloye the peece, if that you cannot by no meanes, stall the peece, and then put in cleane water at the tutchhole, vntill that it dooth stand full of water, and then koyne vp the breach of the peece, that the mouth of the peece may stand dripping downe-wards, and so let the water drop out of the mouth a two or three daies, and still put in more water, and keepe the tutchhole full of water, and so by that meanes the water will soake out all the Peeter from out of the powder in the peece, and then that being done, you may prime fresh powder in at the tutchhole, as much as may be sufficient to blow out the shot that is in the peece, and in like manner you may saue the Peeter, by setting a tubbe or vessell vnder the mouth of the peece. &c.

*The 34. Deuise.*

**I**F through treason or otherwise, the enemies haue cloyed the touchholes of your Ordinance, and that you haue no Drill for to bore it out vpon the suddaine, and yet you are driuen to vse your Ordinance, then scale your peece, both the shot and the wadde, but not the powder, and then put in a lower or smaller shot without a wadde, and then make a traine of powder from the powder in the peece, vnto the mouth of the peece, and then giue leuel vnto your enemies, and so giue fire at the mouth of the peece, and then the force of the blast of the powder will blowe out the naile or spike out of the tutchhole: but if it do not, then  
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heate the peece there abouts the tutchhole, and then take a quantitie of waxe or clay, and make it like a cop about the tutchhole, and then take oyle and heate it hot, and powre it on the tutchhole, and that will so seeke by the sides of the nayles, that when you doo loade the peece and shoothe her off (as afore is declared) there is no doubt but it will blowe out the nayle, and cleere the tutchhole of the peece.

*The 35. Deuise.*

**I**F so be it hapneth so, that there is in the passing of an armie a riuer or water in the way, and the water to bee of great deepenes, and they hauing no boates, and that they can make prouision to put ouer their men, now to carrie ouer their Ordinance, they may do this: first, with planck and timber let them make a thing square like a platforme, of sufficient strength, and then let them place one of their peeces of Ordinance vpon it, and then let them prepare emptie caske, and let them bee made tight, and then take as many of these caske as may be sufficient to boy or swim with the sayd peece of Ordinance, and then let this caske bee made fast, and fraped hard vnto the sayd platforme round about the sayd platforme, aloft vpon the platforme, for the platforme must not be vpon the caske, for then the weight of the peece would ouerthrowe the platforme, and so they may conuey their Ordinance ouer any haueu or riuer, without boates, and so they may make as many of these platformes as is sufficient to serue their turne, and you may know how many caske will boy or swimme with any peece of Ordinance, as this: fise tunne of caske will carrie a double Cannon, foure tunne will carrie a pernie Cannon, and three tunne or lesse will carrie Culucring, &c. taking any thing more than a pipe or boat vnto 1000. weight of the peece. &c.

*The 36. Deuise.*

**F**OR to knowe whether any peece of Ordinance be sufficiently mettalled to beare her charge with powder, then this is generall, that in the clamber before the tutch-hole, so far as the powder doth reach to the mouthwards, that the mettall is in thicknesse as high as the shot is round abouts, and somewhat thicker, and if that the mettall bee not in thicknesse as much as the heighth of the shot, then she is too slenderly mettalled.

*The 37. Deuise.*

**F**OR to knowe whether that any peece of Ordinance bee cleere within without any honeycombs or cracks, then take a Steele Glasse when that the Sunne shineth, and then turne the beame or shaddowe of the Sunne into the peece mouth, and so you shall see into the peece, whether there bee any flawes or hony combs in the peece by the light of the Sunne vppon the Glasse. And also, if the Sunne shine not, then take a short Candles ende, and then take a long pole sticke, that may reach vnto the bottome of the peece, and make a cleft in the end of the sticke, and then put that into the mouth of the peece vnto the bottome, if you see cause, and so you shall see if that there be any faults in the peece in like manner.

*The 38. Deuise.*

**A**ND furthermore, you may breake any peece of Ordinance, although that the peece of Ordinance be sufficiently mettalled, & without cracks, flawes, or hony combs, and also hauing no more but her common charge or lading, as this. If that it hapneth so that you might come by  
your



your enemies Ordinance, and they being laden alreadie, you might cause them to breake at the next shooting of them in this manner. Prepare certaine things made of yron, made of purpose, of a foote long or more at your pleasure, and the poynt to be very thin and sharpe, and smooth, and at the other end to be halfe an ynch thick or more, and to be smooth and taper ground from the poynt vnto the greater end, and then put into the peece that thing close vnderneath the shot, and then the shot being round, it is apt to run vpon that, and then the peece being shot off, the shot will be choaked, or stick fast in the peece by the meanes of the bigger ende of the thing of yron put into the peece, for that the shot hath no roome for to goe by, and then the violent blast of the powder must needes breake the peece.

*The 39. Deuise.*

**A**S touching the giuing of leuell with any peece of Ordinance, and for to knowe if that the leuell be laide awry, and for to knowe how much awry the shot will be at the marke, it is thus knowne; looke how many times that the length of the peece is vnto the marke, so many times that quantitie that the peece is laide awry, so many times that quantitie that the length of the peece is vnto the marke, so much it shall be awry at the marke: as for an example, the peece is ten foote long, and it is laide one ynch awry beside the marke in the giuing of leuell, and the marke is twentie skore from the peece, and there is fixe times the length of the peece in euery skore, and the marke beeing twentie skore off, the shot must bee fixe time twentie ynches beside the marke, and that is ten foote; as I doo more at large declare in the tenth Chapter of my Booke called *The Art of shooting in great Ordinance.*

*The 40. Deuise.*

**I**F that any place be besieged, & haue no Ordinance for to defend themselues as many times in the middle of a Countrey that are not neere the fronters, there may bee great Cities or Townes that are well walled, that hath no Ordinance, and may many times lack diuers things meete to defend themselues, as powder and shot, &c. and yet they haue strength ynough of men to defend themselues, and yet notwithstanding they may make prouision for to make both Ordinance, and also powder and shot, &c. although that they haue no other mettall, but onely leade: and there is lightly no Citie nor Towne, but that it hath leade good store, & then they may make them Ordinance of leade to serue their turne by the good foresight in the basting thereof, that is to say, to put in the more substance of the mettall: for let them make the thicknesse of the mettall to be round aboutes, once and a halfe the heighth of the shot, the peece will bee able to beare the ordinarie charge of powder, and then the weight of that peece will bee more than double the weight of that peece which is of brasse or yrou: And in a Towne where as is helpe ynough, it maketh a great matter for the weight, for that they haue no great cause for to transport it very far. And also, they must not shoote in those peeces too often at a time, for heating of them too hote, but they may shoote moderatlie, and vse them so, that they doo not ouerheate them, &c. And as for powder, the vse of the making thereof is commonly knowne vnto all men, and there is no Towne, but that the earth in some places is good for to make the Petre of. And as for shot that may be cast of any mettall therefore if that they haue any persons of experience, they may both make them Ordinance, and also powder and shot to serue their turne, &c.

*The*



*The 41. Deuise.*

**N**OW shall follow two or thee deuises, which is a common question among Gunners, although that there is no vse of seruice in it, and that dooth appertaine vnto Ordinance, more for pleasure in the wagering thereof, than to any other purpose, as this to say, I wil outshoote any person in one peece with all one kinde of shot, both in weight and otherwise, and with one kinde of powder, and with equall weight, and in the like kinde of aduantage in all poyntes, and that is by this meanes, the shot to be both fit for the peece: then prepare a peece of linnen cloth or wollen, and then wooll that same round about the shot, that the shot may goe stiffe into the peece, that it may goe home vnto the powder, and in so dooing, you shall shoote further than it would doo, if it were vnwoolled. And also, if that you doo shoote in a peece both with one kinde of shot, and with one weight of powder, and like aduantage in all poyntes, the last shoote shall ouer shoote the first by this meanes, for that the peece is made warme, and that causeth the powder to fire the better together, &c.

*The 42. Deuise.*

**A**S touching this, how to lade a peece at one time, and to make the peece to shoote three times off at the once lading of the peece, which is done in this manner. First prepare a peece of small match that will keepe fire, or else a peece of blew threed, and that will keepe fire, and then put the one ende of that into the mouth of the peece, so that the ende goe vnto the breeche of the peece, and the other ende to hang out, and then lade the peece but meanelly, so that she haue not hir full charge, and then put in a close wad, and then lade the peece againe but meanelly

meanely with some lesse Pouder than it had at the first, and then put in another close wad, and that done, then lade hir the third time, and put vp the Pouder close, but you neede not wad it, except you list, and then set the end of the threed on fire, and that will fire the first, and make the peece goe off, and yet the threed burneth still, and so shooteth off the middlemost, and afterwards it burneth vnto the last, & so the peece hath shot off three times, and this you may do by handling it discretely, and may shoote a shoote at euery time.

*The 43. Deuise.*

**F**OR to make a peece goe off at any houre or time appoynted, although that there be no person there to giue fire vnto the peece, yet this you may doo, and it will goe off at any time appoynted, as this. First the peece being charged, take a match, and proue what length it will bee burned in an houre, & when you know iustly how much in length will be burned in an houre, then according vnto that time that you would haue the peece goe off, measure out so much iust in length as wil be a burning in that time, and then at that place, let it be laid at the tutchhole, the peece being primed to lay powder vpon the match, & then the other ende to bee fired, then when the match is burned vnto the powder, the peece will goe off, and so by this meanes the peece will goe off at any houre or time appoynted, whether that it bee in long time, or short time, &c.

*The 44. Deuise.*

**F**OR to make a peece goe off when that you list, you nor no other person being there for to giue fire vnto it, you must doo this, the peece being loden and primed; then in  
the



the tutchhole take a peece of small wyer, of two or three ynches long, and bend it, that both the endes may come together, and then put that into the tutchhole of the peece when that the peece is primed, and the bought ende to stand vpwards, and then put the ende of a long string through it, and then lay a little powder vpon the tutchhole, and there make a peece of match fast vnto it, and let the match be lighted, and then the other ende of the line you may carrie vnto what place you list, and then when that you would haue the peece shot off, then drawe or pull the line or string, and it will giue fire vnto the peece, &c. And also you may set powder on fire with a burning glasse where the Sunne shineth.

*The 43. Deuise.*

**F**OR to knowe whether that any peece of Ordinance be truly bored, that is to say, that the core or hollownesse dooth goe right in the middle of the mettall, that it doo not decline or leane more vnto the one side, than it dooth vnto the other side, for to knowe the same, doo this. Take two streight staues, and make them fast at the one ende, that they bee not wider asunder at the one ende than they bee at the other ende, and so made fast, that they doo not swaue, and then put one of the staues into the mouth of the peece nere vnto the tutchhole, and then trie the peece round about on euery side with an ynche rule, and so you shall knowe whether that the core or hollownesse dooth goe right in the middle of the mettall, and if that it doo not, you may knowe by the ynch rule how much it doth differ, &c. as I doo more plainly shew in the second Chapter of my Booke called *The Arte of shooting in great Ordinance.*

## The 46. Deuise.

FOR to knowe whether that any peece of Ordinance be tapered bored, that is to say, that it is wider at the mouth, than that is within towards the breech of the peeces, that you shall knowe by this meanes, take a rammer head vpon a staffe that is the true heighth of the mouth of the peece, which within a quarter of an ynch, or els that it may goe close, and then put that into the peece, and if that it doo go down vnto the breech of the peece, then it is not tapered bored, but if that it will not, then it is tapered in that place, and then take a lower rammer head, and then proue againe, and so by making diuers proofes, you may know how much that the peece is tapered bored in euery place, and the peece may be so tapered bored, that it may bee much the worse, and the same may bee so tapered bored, that it is neuer the worse, but rather the better. They are the worse tapered bored, that are wide at the mouth, and narrower and narrower inwards, for this cause, that those that do lade the peece, and do not know it, may put in a shot that he dooth thinke is fit for the peece, and that may rest by the way, and not goe downe vnto the powder, and that may chance to breake a peece. And also, if the shot bee so small, that it will goe downe vnto the powder, then it is possible the shot being too small for the mouth of the peece, that it may swaue in the deliuerance, and also, the shot wil not flie so far as it would do if it were close for the mouth of the peece, &c. Now those tapered bored peeces that be neuer the worse, as those that are all of one heighth, equall within a foote, or a foote and a halfe of the breech, and afterwardes vnto the rutchhole is narrower & narrower, those peeces are not the worser, but rather the better in some respects, for that it is stronger, so that the shot may goe close vnto the powder, for the greatest faule



fault that may happē by that meanes, is this, that the plate of the ladell must bee the rounder bent, and also in the sponging, there may bee a fault: for if the Sponge bee too big, it will not goe vnto the bottome, and if it be fit for the bottome, then it will be to low for the rest of the peece, &c.

*The 47. Deuise.*

**F**OR to knowe how thick any peece is in mettall in euery place, you may knowe it by the 44. deuise going before, as you doo trie whether the peece bee truely bored: and also if the peece bee truely bored, you may trie the thicknesse of the mettall in this manner, take the thicknesse of the whole mettall with your Calleper Compasses vpon the outside of the peece, and then trie it with an ynch rule how many ynches high the mouth of the peece is, and then pull that from the whole thicknesse of the mettall, and then looke what dooth remaine, then halfe that shal be the true thicknesse of the mettall of the peece in that place that you haue measured, and by this meanes you may knowe the thicknesse of the mettall in euery place, &c. And also, if that you haue no Caleper Compasses, then you may plome the peece vpon both the sides with a plommet of leade vpon a string, by laying a twofoote rule crosse the breech of the peece, dooing afterwards as before is rehearsed. And also, if that it be a round peece, then you may gird the peece, and so finde the thicknesse of the whole mettall, as I doo more declare in the fourth Chapter of my Booke called *The Arte of shooting in great Ordinance.*

*The 48. Deuise.*

**F**OR to knowe how many ynches, or what parte of an ynch will make a degree in any peece of Ordinance, to

be leuell at any marke, with an ynch rule, it is thus known: first measure the length of the peece, how many foote it is in length, and then double that measure, & then multiply that number of feete into ynches, that done, as 7. vnto 22. seeke the circumference of such a circle (that is to say) first multiply that number of ynches, double the length of the peece by 22. & look what that commeth vnto, deuide that againe by 7. & that will shew the circumference of such a circle, and then deuide that number againe by 360. & that will shew vnto you how many ynches & parts of an ynch will make a degree, &c. as I doo shewe how many ynches and what parts of an ynche will make a degree, for the length of sundry peeces in the 8. Chapter of my booke called *The Arte of shooting in great Ordinance, &c.*

#### *The 49. Deuise.*

**A**Nd furthermore, as touching the making of a shot by Sea out of one Ship vnto another, this is to be considered, the heauing and the setting of the two Ships, and also the stirring, as I doo more at large declare in the 14. Chapter of my Booke called *The Art of shooting in great Ordinance*, but to giue leuell vnto any marke or ship for the rightnesse thereof, this is the best way in a Ship not to stand poring at the breeche of the peece, as it is commonly vsed amongst Gunners, but to giue leuell right do this. You hauing giuen the peece the height that thee shall lie at, then as you shall see cause, bid him that is at the helme to goe aloofe, or romer, and then let one stand ready with a lintstock to giue fire, and then stand you right behinde the peece a two or three yardes off, & then marke the middle of the mouth of the peece, and the middle of the tayle of the peece, that by the casting off, the Ship be right with the mark by the sight of one of your eyes, then giue fire, & you may be assured that the shot goeth right, &c.

*The*



*The 50. Deuise.*

**A**Nd also in the placing of a batterie against any Town, it is to bee foreseene that you may flancke the front of the batterie, and also the pits or ditches that you haue laid your labourers in, that do hale the bousing tackels to bring the Ordinance vnto their places againe when that they are laden. &c.

*The 51. Deuise.*

**A**Nd furthermore, as touching the Ordinance in shippes, and especially that Ordinance that is vnder the Decks, for that it is very troublesome to hale them in, and lade them, and especially if that the ship doth held with a Sail-bearing. And also, it is troublesome to make a shot at any marke if that the ship doth held, for that both the Trocks or wheels will alwaies runne close vnto the ships side, so that he shall neuer bring the peece right vppon the marke, except that he be able to coon the ship for to doo it with the Steeradge. Wherefore in my opinion the carriage of of the Ordinance that is vnderneath the Deck, were much more readier and easier to be handled, to bee made in this forme following, that is to say, the carriage for the lower parts to goe vppon foure lowe Trockes, as the common mountant carriage that in the shippes is now vsed, but the vpper part that the tronions lieth in, to goe vpon an Axel-tree or Standard, as a Windmill doth, and then this peece when it is either to bee pulled in, or els to bee laden, then there is no more to bee done, but to bring the peece right backe vppon the Trockes, and then as soone as the mouth of the peece is within the port, then to beare the breech or taile about, as you doo the taile of a Mill, and then you may lade her, and so turne her mouth against the port a-

gaine, and so put her out without any lifting of the Trocks of the peece about, as is now vsed, which is a great payne and a trouble in a great peece of Ordinance, and also, they cannot bring the peece vnto the marke, except it be by the Steeradge (as before is declared) and if that the ship dooth heeld, but if that the peece be in this kind of carriage, then although that the ship dooth heeld neuer so much, and although that both the forewheeles or Trocks doth runne close vnto the shippes side, yet notwithstanding the peece lying in that kinde of carriage before rehearsed, yet neuerthelesse the peece may be put off from the one side of the port vnto the other at your pleasure, as farre as the port will giue leaue, for that the peece is to bee put too and fro euē as a brace that standeth on a Mych, for that the peece doth stand vpon an Axeltree or Standard, as a mill doth. &c.

*The 52. Deuise.*

**A**Nd also there is deuised by a high Dutchman, how to make the carriage for any small peece of Ordinance, as a Falcon, or Falconet, or a Rabnet, to lade her backwards, and so to turne her forwards againe, and so shoote her off, for that this peece hath no Axeltree, but that there is made fast vnto the carriage or stock, two stoores, or part or ends of an Axeltree, whereon the two wheeles doth goe vpon, so by that meanes the breech or taile of the peece, is to bee letten downe, and the mouth of the peece to be turned rosey turuey right backwards, for that there is neither Axeltree nor transome in the stocke or carriage, to let the turning of the peece ouer againe. &c.

*The 53. Deuise.*

**A**Nd also there is deuised by *John Skinner*, one of the *Queenes Maiesties men*, a certaine scerewe, to set vnderneath

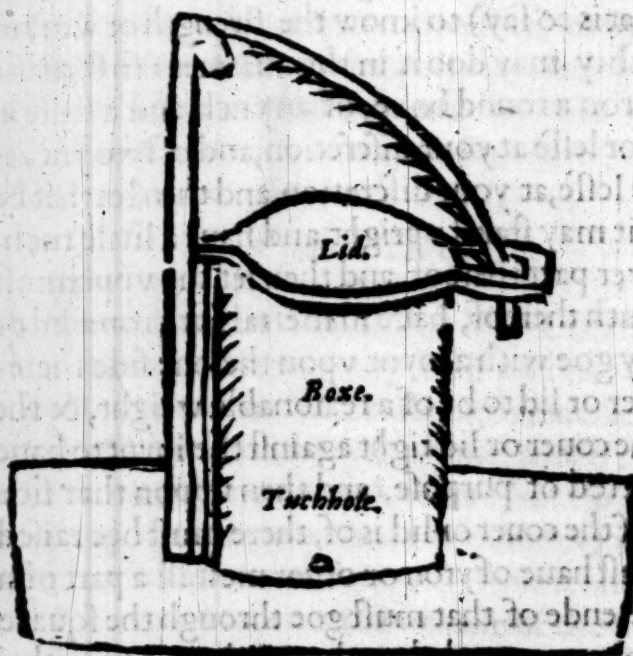


derneath the taile of any peece of Ordinaunce : so that you may bring her vnto what leuell that you list, without any coynes: which is very necessarie to bee vsed for great Ordinance in a number of causes, for that it shall take away the charge of the carrying of coynes, and yet much more better than the coynes be.&c.

*The 54. Deuise.*

**A**Nd as touching this, how for to make an Instrument or Engine for to knowe the goodnesse or the badnesse of powder, (that is to say) to know the strength or weaknesse thereof, they may doo it in this manner: first, make in mettall or yron a round boxe, of an ynch and a halfe in breadth more or lesse at your discretion, and of two ynches deepe more or lesse, at your discretion, and then let that be placed so, that it may stand vp right, and haue a little tuch-hole at the lower part thereof, and then let the vppermost part at the mouth thereof, haue in mettall or yron a lid or couer, that may goe with a ioynt vpon the one side thereof, and the couer or lid to be of a reasonable weight, & the other side of the couer or lid right against the ioynt to haue a square hole fitted of purpose, and then vppon that side that the ioynt of the couer or lid is of, there must bee raised a thing that must haue of yron or other mettall a part of a circle, and the ende of that must goe through the square hole in the lid or couer, and the other ende to goe with a pinne or ioynt right ouer the ioynt of the couer or lid, and the sayd crooked thing or part of a circle, to haue teeth or notches, like vnto a Sawe, and the teeth to stand vpwards, and then it is finished, and then, whensoever that you list to proue the strength of powder, and your hauing of diuers sortes of powder, then wey some small quantitie of the powder, and then put that into the Boxe, and then let downe the couer or lidde, and then giue fire vnto it at the

the touchhole, and then the powder will blowe vp the couer or lid, and then the teeth or notches being well filed or trimmed of purpose, will holde vp the lid at the highest, and yet not staying in the blowing of it vpwards, for that the teeth standeth so, to stay it that it shal not come downwards, and then trying or prouing diuers sorts of powder, you shall knowe which is the best or strongest powder, or weaker powder, by the blowing vp of the lid or couer, you putting in the powder by weight. &c. And this is the forme of the engine or instrument.



### The ss. Deuise.

**A**S diuers Gunners and other men haue deuised sundry sorts of fire-works for the annoyance of their enemies, yet as farre as euen I haue seene or heard, I neuer know nor heard of any good seruice done by it, neither by sea nor by land, but onely by powder, and that hath done great seruice,



## *and strange Deuises.* 41

uice, for that the force of it is so mightie, and commeth with such a terror. But for their other fire-workes, it is rather meetest to be vsed in the time of pleasure in the night than for any seruice. And for to make this kind of ball, do this: Prepare the mould of a double Culuering shot, and that is five ynches high, and then take clay, and make it round in a ball, as much as a Minion shot, that is three inches high, and then let it be dried as the Founders doo vse to drie their moulds, and then stick that clay round about with yron nayles, leauing the nayles an ynce without the clay, and then put that moule of clay into the moule of the Culuering shot, and looke that the nayles do so beare, that the ball of clay doo stande right in the middle of the mould of the Culuering shot, and also, make the mould of clay, so that it may haue a tuchhole to come into the clay, and then take Bell mettles or other course pot brasse, and then fill the mould of the Culuering shot with that mettell, and that being done, then it is finished, and so make as many of them as you list, and then that being done, picke out all the clay againe that is in the ball, that was cast in the Culuering shot mould, and then fill that with good corne powder, and then that beeing filled neere full, then take some receite of soft fire worke, that will not burne too hastily, and fill vpon the rest of the ball, and then it is perfectly finished. And then in the time of seruice either by sea or by land, it is very good to throw in amongst your enemies, where they doo stand thicke, as they bee very good to defend a breach, or such other like causes, as this, to take it in his hand and to fire it, and then to throw it amongst your enemies, and as soone as the fire-worke is burned vnto the powder, the ball will breake in a thousand peeces, & euery peece in a manner will doo as much hurt as a Harquebuz shot, so that there is no kind of fire-worke comparable to this kind of Ball, for seruice in the time of neede.

*The*

*The 56. Deuise.*

**A**Nd also as touching the fire workes, they may make a truncke that may shoote 20. or 30. or 40. Caliuers or Harquebuze shot, and deliuer euery shot seuerally by it selfe, and to come out with great force, as this: let the Truncke of fire-work be made according vnto the accustomed manner, and with the kinds of receites, and then either the wood being thicker than of custome, or els some pretie pipes of yron put into the sides of the Troncke, and to go through vnto the fire worke in the Trunck, and then fill all those with good corne powder, and a shot after it, and then as the fire worke dooth burne downewards, so it dooth shoote off al the Harquebuze shot that is on the outside of the Trunck, if that there were 40. of them. &c.

*The 57. Deuise.*

**A**Nd also there is deuised a certaine Engine, that goeth some with a scrowe, and some with a nut, yppon teeth that you may lift vp the side of a whole double Cannon, setting it vnder the Axeltree, and so you may take off the wheele of the Cannon, & these be very much vsed in Germany, & in Dutchland, to lift vp the side of a great Dutch wagon when that it is laden. &c.

*The 58. Deuise.*

**A**Nd furthermore, for that I haue seene the inconuenience thereof, as touching the lading of Ordinance in ships, and especially of those Ordinance that are vnder the Decks, in the time of seruice, when that they doo charge their Ordinance with a ladel, it is very comberfome, for that the ladle must be twise filled, and the twise turning of the



the rammer head, is troublesome in a streight roome, besides the opennesse of the powder, in the dooing thereof, whereby there may grow great inconuenience, if that they be not very circumspect in the doing thereof, and furthermore for to lade a peece with a carteredge, there is this inconuenience in the dooing thereof: for if that the peece haue any hony combs in it, that may chance to stay or let the carteredge, in such sort, that you shall scant get the carteredge home vnto the bottome of the peece: for if by chance that the carteredge should double, or sticke, or goe awry by the way, you shall haue very much for to doo to drue it home vnto the bottome of the peece, whereby in the time of seruice there might happen great inconuenience to be so combered. &c.

Wherefore I will shewe vnto you how that you may make an Engine that you may call a charge that shall lade a peece at one time, and shall be done as soone as you shall doo it with a carteredge, and also you may emptie the carteredge into the charge, and shall ram vp the powder all at once, and lay it more close than the ladle without the turning of the ladle or of the rammer head, and shall keepe the powder more close than the ladle shall, and the making thereof followeth as this: first take a ladle head, such an one as the ordinarie ladles hath, and then take the plate, such a plate as you make all ladles of, but that you must haue more plate than the ladle hath, and then when that you would make this Engine or charge for a peece, then bende the plate rounde, that it may goe easily into the mouth of the peece, and then make it fast vnto the head of the peece, that is fit for that peece, and let the plate of the charge bee of such length, that it may holde so much powder as is sufficient to lade the peece, and then the hole that is in the charge head, let that bee made wider than the ordinarie Ladle heades, that it may haue a staffe goe casilie through it, to that intent that you

may drawe it in and out at your pleasure: and then fitting that with a staffe, then put vpon that staues end a rammer head made of purpose, that may goe fit and close in & out through the plat of the charge easily, and then let there be another smaller staffe made fast vnto the charge head, and then it is finished: and then whensoever that you list to lade a peece with that charge, doo this first: drawe in the rammer head close vnto the bottome of the charge, and then fill the charge with powder, and then put that into the mouth of the peece, holding that by both the staues, and so putting it vnto the bottome of the peece, and then thrust in the rammer hard with one hand, and then drawe backe the charge staffe with the other hand, & so drawing backe the plate of the charge, the rammer head thrusteth out all the powder, and so the rammer head doth put vp the powder close in the peece, and will lade the peece cleane without the spilling of any powder, and dooth make but one worke of all: which (in my opinion) is very necessarie to beevsed in the time of service, and is lesse worke than to doo that with a ladell, and if that your powder bee in carteredges, you may put in the carteredge into the charge, or els you may emptie it into the charge, at your discretion.

The charger.

The rammer.

The charge &amp; rammer

The



The 59. Deuise.

**A**ND furthermore, as touching the making of an engine or instrument, which is very necessarie for Gunners for to haue to fit euery peece, with his true weight of powder, & especially for to wey the cartredges that bee filled with powder, & is lesse troublesome than to haue a paire of Ballance: neither shal be vse to haue so many weightes, for that one weight of halfe a pound, shall be able to weye 50. or 60. pound, which kinde of things are altogether v- sed in south Spaine, to wey all kinde of Marchandise, which they do cal Staterie: & it is thus made: First prepare one scale, & then let that be stringed as a scale, or ordinary ballance is, with a hooke at the end of the strings, & then make a beame of yron or wood about three quarters of a yarde long, more or lesse at your discretion, & then with- in anynche of one of the endes let it haue a pin through, and a claue or such a thing as all other ballance haue to holde it vp by, that the pin may goe through, & to be pli- ant to goe too and fro, euen as all other ballance hath, and then to haue one weight, & that to haue a ring, and then, when that you would wey any thing, put the ring vpon the longer part of the beame, to be marked with notches, and at such a notch the ring of the weight being there, it will wey one pound, & at another notch, two pounce, and at another 3. pound, and so forth, vnto 40. or 50. pounce, which is a very necessarie thing for Gunners to haue, to wey their things withall, and is but of small charge.



The



*The 50. Deuise of Martiall affaires by  
lande, as touching the walles of Townes  
or Fortes.*

**A**S touching this, how for to ouerthrowe the wall of a-  
ny Towne or Fort, or Castell, it may bee thus done  
without any Ordinance, so that it bee not watered about  
it, as this, take certaine great timber, and vnderhoare or  
prop the wall in diuerse places, and that done, then dig  
or vndermyne the wall, all alongst the wall side as long  
as you doo thinke it sufficient for your purpose, and for  
vndermyne it, vntill that you bee more then halfe waye  
vnder the foundation of the wall, and then make fiers vn-  
to euery one of the shores or proppes, and burne them  
asunder, and then as soone as the wall dooth misse the  
shoare or prop, and the foundation of that side digged a-  
way, the wall must needes fall presently, &c. And by this  
meanes they may burne the parcoleuses or gates of any Ca-  
stle or Forte, if that they be not of yron.

*The 51. Deuise.*

**F**Vrthermore, they may in like manner breake downe  
the walles of any Castle, or Fort, or Towne, with great  
rammes made of purpose, with great heads of yron and  
steele, some may be made to hang by prouision, and  
to be drawne backe by the strength of men, and so by  
violence to runne against the walles of a Towne, and  
other some may bee made to runne on wheelles, and  
to runne with violence of a number of men against  
the



the Walles, and so breake them downe, and also these kindes of prouision bee moſte ſpeciallie too breake downe the Gates or Parcolleſes of anie Caſtle or towne.

*The 62. Deuiſe.*

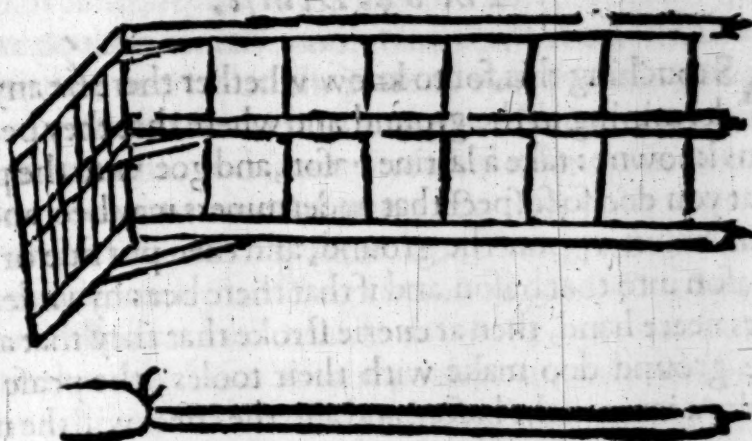
**H**OW to make a ſcaling ladder in ſuch ſort that they that are vppon the ladder, ſhall haue the aduantage in the fight of them that are vppon the vamer of the walles of any Towne, or Caſtle, or Fort, whether that it bee to ſtand at the puſhe of the pike, or handling of any other weapon whatſoeuer that it bee, and this ladder that I ſpeake off muſt be made in this manner. Firſt prepare your ſtuſſe accordingly, of ſufficient ſtrength, and then according vnto the accuſtomable manner, make a double ladder of three pieces of timber, and ſtaue it accordingly, as of cuſtome it hath beene vſed before-time, and then the viewe of the place being taken, that is to be ſcaled, for to make the length of the ladder, then make the length of the ladder accordingly, that it may ſtand or reſt within a foote or two, or three, of the heighth of the top of the Wall, and then for the top of the ladder, doo you cut three peeces of ſmall timber of ſixe foote long, and then let them bee made faſt by ſome meanes at the vpper end of the ladder, that it may ſtand like a platforme vpon the toppe of the Ladder to the wall-wards, and then let there bee three braces ſtand, or made faſt vnderneath the platforme vppon the toppe of the ladder, to beare the platforme from the three ladder ſtaues, vnto the three peeces of the platforme on the toppe of the Ladder, and then to that purpoſe, that men may bee able to ſtand vppon the platforme, on the top of the Ladder there may be ſawen certaine fillettes  
of

of light boordes, that are strong, such as are vsed to bee made for the spardeck or grating of Ships, that may lye so close together, that a mans foote cannot goe thorough, and then at the lower ende of the ladder, to haue three pikes vppon the three pieces of timber, that the ladder doo not slip, when that it is set vnto the wall, and then the ladder is finished. And then to raise the ladder to set it vnto the wall, they must make a forke of timber that must bee as long as the ladder, and that forke dooth serue both for to raise the ladder, and also to stand vnderneath the platforme of the ladder, to bee a staye to helpe to beare the waight of the men vppon the top of the ladder, &c. And this ladder being raised, a number of them, they may stand on the toppes of the ladder, as firmly as they that doo stand vpon the vamer of the wall, and sixe men may stand and fight vpon the top of euerie one of the ladders, and handle his weapon, for there may stand three ranckes of men vpon the platforme, besides them that are coming vp the ladder. And this ladder is twentie times better than the other kindes of ladders in all these respectes. If the other plaine ladders bee too long, then they that do defend, may by force put them ouer: and if that the ladder bee too short but one foote, it will bee so painefull vnto them that shall rise, to recouer the wall, that one man may keepe downe ten men: but in this kinde of ladder, if that it bee three or foure or fife foote too short, yet they may stand and fight, and one may helpe another ouer the wall being armed men, they may get ouer with ease.

The forme of the ladder dooth followe.

*The*





*The 63. Deuise.*

**I**F any towne or fort bee situated in a drie ground, when that they bee subiect vnto vndermining, then to auoyde the danger thereof, they may doo thus, let them first make a vent downe in some place within the towne, and so dig deepe vnder the foundation of the towne, and also vnder the towne ditch, and then when that they haue digged without the ditch, then let them dig all about vnder the ground, as they may conueniently, and so make a waye round about the Towne, vnderneath the ground, on the outside of the towne: and the soyle that they doo dig out, in the digging of it, they may rampier the walls with that stuffe, and then whensoever that they are besieged, and doo doubt vndermining them, they may make search euery day in the faide place, and so it is not possible for them to vndermine, but that they shall heare them, and perceiue where that they be: and also that place will bee a let vnto them. And then you may vse against them what pollicie that you list, to annoy them at your pleasure, and preuent them of their purpose, &c.

*H*

*The*

*The 64. Deuise.*

**A**S touching this, for to know whether there be any vndermining in the ground, and where that they be, it is thus knowne: take a lattine bason, and goe vnto the place that you doo so suspect that vnderminers may bee, and set that bason vppon the ground, and then put fīue or sixe peason into that bason, and if that there bee any vnderminers neere hand, then at euerie stroke that they that are in the ground doo make with their tooles, the pease will make a iarre in the bason: and also the effect will the more appeare, if that you doo binde a sackefull of woll as hard as you can, then setting the bason wiith pease vppon that, you shall heare euery stroake that is made in the ground, and this is one of the best things that may bee deuised to be placed in any place, for to knowe where that vnderminers bee, as in the Deuise going before, to place it in the vaute vnder the ground, or also where that there is no such way vnder the ground, yet they may make diuers ventes or deepe holes in the ground: and this being placed there, they shall heare euery stroke that the vnderminers doo strike, &c.

*The 65. Deuise.*

**A**S touching this, how for to make a caue, to the intent to place powder, and to to giue fire to blowe vp any fort or bulwarke, or the wall of any Towne, it is thus to be done, when that you doo begin for to digge, to make your vent into the ground, let it be of some distance from the place that you doo meane to blowe vp, and then when that you are entred into the ground, then doo not digge right toward the place, but indent it sometimes one way, and sometimes another way, that the way be not streight,



to this ende , that you may fortifie the vent of the way so strongly, that it may be able to resist the force of the blast of the powder, and the vent of the way to be as narrowe, as may bee neere vnto the place or vault that the powder is placed, and in like manner to digge as deepe as you may into the ground, and so when you haue digged neere, vntill you doo come vnto the place that you doo meane to blowe vp, then you may digge somewhat nerer vpwards, that you doo not place the powder too deepe vnder the ground, but at a reasonable distance, and then in the room that you doo place the powder in, there let it bee right ouer the powder or vault of 7.8. or 9. foote higher thā the barrels of powder, to this intent, that it might take his vent vpwards, for the ayre that is in that hollowe place, will be the occasion of the lifting, or raising, or rending of the ground right ouer it. And then when that you haue placed the powder in the vault that is sufficient for to serue your turne, and the more in quantitie, the greater shall bee the effect of the raising of the thing. Then before that you doo ramme vp, or make vp the vent of the way you must make your prouision for the place to giue fire vnto; which is best to be done, by making a troncke in boordes, made and sawen of purpose, to be of length from the mouth of the entrance, vnto the vault that the powder dooth stand in, and that must be placed or laide al alongst, that it may be close, and the prouision put into it, that must giue fire vnto the powder in the vaute : and then ramme vp the waye that was made vnto the vaute that the powder standeth in, both with earthe and strong timber, &c. and that troncke of boordes shall keepe the prouision of the traine, without anye foyle or moysture to hurte it. And you may make your prouision so, that you maye choose whether you will giue fire by a trayne, with a match lying all alongst in it, made of purpose, boyled in

certaine mixtures rolled in Serpentine powder, or else by a small lyne, to goe with a pulley, all alongst the truncke or case, and the lyne to passe through a great quantitie of powder, in the vaute, where the powder standeth, & then when that you would giue fire vnto the powder, then to make the fire fast vnto the line, and so to drawe the fire vnto the powder by a lyne, &c.

*The 66. Deuise.*

**A**S touching this, for to digge a way in the grounde, to come right vnder any place assigned, the way beeing crooked, indenting sometimes this way, and sometimes that way, as it may not be made streight, that is somewhat difficulte, and asketh a good consideration in the dooing thereof: for if that the powder be not placed right vnder that thing that is meant to bee blowne vp, then the thing should be of little effect: wherefore in the ordering of the way of a mine to come right vnder any place assigned, it must be thus handled: first, they must knowe the true distance vnto the place that is meant to bee blowne vp, from the place that you doo begin for to dig, or enter into the ground, and that being knowne, then looke precisely, which way that the place dooth beare, and then drawe or make a plat of the same, with a scale or truncke of measure thereunto appertaining, and then according vnto the distance, from the entrance, vnto the place assigned, draw out how many foote or yardes that you will goe, first on the one side, and then on the other side, indenting the way in the ground, and not to goe right vpon the place assigned, and so by that meanes, knowing what quantitie of measure, you haue gone, first one way, and then another way, in the grounde, and by that proportion in the way, both by the direction of the way, and the quantitie of measure: in the way you may go directly  
vnto



vnto the place assigned in the ground, and you may marke your plat firmly, how that you will do it, before that you doo enter into the ground, according vnto the distance of the places assigned. And also it may happen so, that when that you are in vndermining in the ground, and haue purposed to goe so many foote one way, and so many foote another way, and that you haue made your plat so, yet there may bee such impediments or lets in the ground, that you cannot doo it according vnto your first meaning, then you may mend it and alter it in your plat, according vnto the way that you may goe, and so to come vnto the true place assigned, and so you may alter your plat according vnto the place that you may goe, vntill that you doo atteyne to come vnto the place assigned, to marke the vaute in the ground to place the powder in it.&c.

*The 67. Deuise.*

**I**F it happen so, that those that haue besieged a Towne, haue made a breach in the wall of any Towne, and that they doo continue to batter both night and day, so that they cannot make vp their breach in the night: then the next way is to make that place defensible in this manner: let them cast a ditch or trench within, on the inside of the wall all alongst the breach, right against it, of a sufficient depth, and of widenes, to bee defensible, and then let them place their Ordinance against the breach, and also flankers in like manner, to scoure the ditch within on the inside of the wall.&c.

*The 68. Deuise.*

**I** Doo thinke it not vnmeet to bee spoken of this, for to knowe if any ditch or trench be cast, that if the ditch bee made so many foote broad in the brimme, and so many

foote broad in the bottome, and so many foote deepe, that if you would haue a wall or rampire made of that stuffe, if you would haue it so many foote broade in the bottome, and so many foote broade on the top, then to know iustly how many foote high the wall will be of that stuffe, which is hewed out of the ditch, when the earth is settled : or els for to know if that you would haue the wall made so high, then to knowe what thicknesse that would beare, being made of that stuffe which is hewed out of the ditch : and for to knowe that, doo this. First, according vnto the widenesse of the ditch in the brimme and in the bottome, put both the numbers together, and that done, then take halfe that number, and then according vnto the deepnesse that you meane to make the ditch, multiply the two numbers together, that is to say, the number of feet of the depth of the ditch, and the breadth thereof at the brim, and the bottome being added both together, and then looke what number it commeth vnto, then if you would knowe how high it would make the wall at such a thicknesse at the bottome, and the top, then adde these two numbers both together, and then take halfe that, and deuide that out of the number of the ditch so multiplied, and that number that standeth in the quantitie line, shall bee the heigh of the wall. And furthermore, if you would haue the wall so many foote high, and would know how many foote thick it would bee of that stuffe, then deuide the heigh out of the number of the ditch so multiplied, and that which standeth in the quantitie line, shall be the thicknesse of the wall in the middle, and then you knowing that, you may vse the thicknesse of the bottome and the top at your discretion. And for the better vnderstanding of the matter, you shall haue this example by a ditch that I would haue made of 20. foote broade in the bottome, and 10. foote deepe, and I would haue a wall made of that stuffe, to bee sixteene foote at the bottome of the wall, and eight foote

at



at the top of the wall; now my desire is to knowe how many foote high it would be, of that stuffe that commeth out of the aforesaid ditch when the wall is settled and dried; you shall knowe it thus: first adde the widenesse of the brim, and the bottome of the ditch both together, & that is twentie foote for the brimme, and twelue foote for the bottome, and those two numbers together, maketh 32. then take halfe that number, and that is sixteene, and then the deepnes of the ditch being tenne foote, multiply them two numbers together, that is to say, sixteene times tenne, and that maketh 160. and now I would haue the wall sixteene foote broade at the bottome, and eight foote at the top, and those two numbers added together, maketh 24. and halfe that is 12. foote: now my desire is, to know how many foote the wall will bee high, which to knowe, doo this: deuide the 160. by 12. which is the thickeesse of the wall in the middle, and that number that standeth in the quantitie line, is the heighth of the wall, and that commeth vnto thirteene foote and foure inches iust, so that you may conclude, that a ditch being cast, that is twentie foote at the brimme, and 12. foote in the bottome, and 10. foot deepe, will make a wall of sixteene foote at the bottome, & eight foote on the top, and 13. foot  $\frac{1}{2}$  in heighth. &c. Furthermore, by the example of the ditch, I would haue the wall fifteen foote high, my desire is to know how thick the wall would be of that stuffe, then deuide the aforesaid number of 160. by 15. and then there will stand in the quantitie line 10. and 10. will remaine ouer, so that you may conclude, that the wall of 15. foote high, will be 10. foote thicke, & eight inches, and then you may at your discretion, make it as broade in the bottome as you list, and looke what you do broade it in the bottome, it will lacke the same at the top. Therefore if you make it 15. foote at the bottome, it will be but sixe foote, and eight inches at the top.

*The 69. Deuise.*

**A**S touching the intrenching either of an armie, or the inclosing of a Towne, they must obserue this order, that they may flank the corteine of the trenches, and in the more places, that they may flank the more stronger, is the places so intrenched, and also most specially to flank the corners, or collyan poynts, and also the waies or torne peeces, where that there is vents for people to passe in and out: and also that order is to bee obserued in the building of any fortification, as the walles of Cities, or Townes, or Forts, or Castles: for if it be so that they cannot flank the sides of the walles, the thing can bee of no force, as commonly all those Castles and Forts that were builded in the time of King *Henry* the eight, were rounds, or parts of rounds, which are of no force, for that they cannot flank the ditches. Wherefore I had thought for to haue shewed what manner of corteine of a wall is the best kind of fortification, which I doo omit, and you may make the number of corners or collyans poynts, with the cortaines of the walles, according vnto the quantitie or bignesse of the Citie, Towne, or Fort, at your discretion, as neede doth require, as foure square, or fiue square, or sixe square, or seauen or eight square, as neede shall require, according vnto the bignesse of the place. &c.

*The 70. Deuise.*

**A**Nd as touching the beseeing of a Towne, they must deuise to make a trench, that the people may passe to the Campe and from the Campe, without being spoyled with the shot of the Towne, which is commonly called a rolling trench, and it must be thus made, as comming nere within the shot of the Towne, at some conuenient place,  
either



either coming out of some wood, or els behind the brow of a hill, there to begin to cast the trench, first to goe right out one way and cast the earth to the townwards, and then to turne another way, and so to cast the earth towards the townwards, and so to continue, first one way and then another way, vntill that you doo come vnto the Campe, and so in that trench the people may passe too & fro with safetie, and also they that are in the towne cannot know what number of men there doth passe too and fro, &c.

*The 71. Deuise.*

**A**S touching this, I doo not thinke it vnmeet to be spoken of, how for to shadowe men on a platforme, where that they are vnprouided of baskets, as it may happen in diuers places on a platforme by the sea side, or on a platforme on the top of the wall of any towne, or in such other like places, when there happeneth to be any seruice on the suddaine, where as great Ordinance is placed, and that for the opennesse or barenesse of the place, that they haue nothing to shaddowe them, but that the small shot dooth or may beate them from their Ordinance: then to preuent that, this is the remedie, for to prepare canuas, and set vp stanchines all alongst, and so to shaddowe their men with the canuas, and then when that the peeces bee laden, then with a peece of a line to drawe vp the nether edge of the canuas, and so to leuell the peece, and shoote it off vnder the canuas, and so by that meanes the enemy shall see no marke to shoote: for otherwise they will bee shooting at the place whereas they doo see any number of men together: but if that they doo not see to what place that men doo assemble together, they cannot tell where for to shoote with their small shot. And also, I doo not thinke this deuise hurtfull to bee vsed vpon the tops of the walles of a towne, whereas men haue any great

recoverye, and also if that any man list to looke towards the enemye, he may but put vp the cloath, and see better than they may doo out of any lops, for that they will alwaies awaite with their small shot, to see if that there be any peering out at the lops to shoote at them.

### *The 12. Deuise.*

AS touching this, how for to knowe of any things done, or to bee done speedily and in the shortest time, some haue deuised to do it by one meanes, and some by another meanes, as this : by the preparing of certaine swift horses, being layd in diuers places, at the end of euery eight or ten miles, to the end to haue fresh horses, &c. which is the best way. And other some haue deuised to doo it, by trayning vp of a dog to goe betweene two places, and then he being beaten from the one place, will runne vnto the other place directly, and then when that they would haue any letters sent speedily, then they haue made prouision to hang them about the dogs necke, &c. and a dogge will runne a great way in a little time, if hee had reason and did vnderstand what he were willed for to doo, but the swiftest way is to bee done by that meanes which the Romanes taught the English Britaines, when they caused them to make a wall to defend themselues against the Picts, which was by certaine tronckes made of brasse layd in the wall : and at the ende of euery two or three mile they had a gate, which was both watched and warded, and so by that meanes whensoever that they had any occasion to giue any warning vnto them that should defend the sayd Picts, then looke vnto what place that the Picts did make any assault vnto them, they were certified through the sayd tronckes of brasse, where that they were, and what hurt they had done, and what number that there were of them, &c. and by this meanes they would haue word what was done, and what was



was to be done twenty or thirty miles in one houre space. Wherefore in my opinion this is a very good deuise for to be vsed in the walles of any towne of warre, to bee layd all alongst the walles of the towne from the one gate vnto the other gate, whereby there might bee warning giuen from any one place vnto another vpon the suddaine. &c.

*The 73. Deuise.*

**A** Stouching this, how for to conuey letters secretly, and not to be found and knowne, whereas there is great a- waite layd, and great search made vpon euery perion that doo passe too and from for letters, you may doo this: you hauing some Dogge or some bad Spaniell that will not bee lost from you: and some Dogge that will not come vnto hand to bee taken vp, prepare a collar for him that may be hollowe within, and let it be a collar to looke vnto woorth nothing, and in that collar you may conuey your letters without any suspicion, for the man may be searched, and yet the Dogge will followe his master running too and fro, and no person can tell whose Dogge it is, and will as soone take the Dogge to be some of their owne companies, as otherwise. &c.

Another way to conuey letters secretly, is, to make vp the letters and roule them vp rounde together, and then they may cause some kind of boxe to be made of mettall, with a close couer, to be round and long, so that it may goe into the mouth of a bottell, and then the letters being put into that smal boxe, and the boxe couered and made close that no licour can soake into it, then put that boxe into the bottell, and then you may fill it with wine, or such other like, and sende that by any person that you would haue them come vnto, and it will not lightly be suspected. &c.

*The 74. Deuise.*

**A**Nd furthermore, if that you haue any great quantitie of letters or bookes that you would conuey secretly, and would not neither lose them, nor haue them found, nor knowne, and that there is waight layd for such things, then doo this : first prepare a runlet or small barrell, that will be made tight, of sufficient bignesse to hold those letters or bookes, and then lap them in a seare cloth, and then take off the head of it, and put them into the small barrell, and then put in the head of it againe and hoope it vp close againe, and make it tight that no lickour may come into it, and then take a great caske, a butte or pipe, or a hoshead at your discretion, and then take out the head of that and put in the small barrell with letters, and so put in the head of the great caske againe, and so make it tight againe, and then you may fill that caske with wine, or with whatsoeuer you list, &c. And then that caske or peece of wine lying amongst other, it may be transported from place to place at your discretion, and neuer to be knowne what is in it, no otherwise then the other caske, and it may be tasted at any of the heads or sides in euery place, as the other vessels are in all poynts, and there shall be nothing seene nor knowne: and also it is very good for you to sow the little barrel in a peece of course wollen cloath, and then it will not knocke in the vessel to be heard in the remoouing of it too & fro, and then you may transport it either by water or by land, and it will neuer be suspected. &c.

*The 75. Deuise.*

**A**Nd furthermore, there may be such meanes made, that you may knowe the minde of your friends, although that you may not come at them, nor sende vnto them, by  
the



the forme of certaine lightes in the night, as this, you hauing consulted or talked together, that if that they doo shew you so many lights, and standing on such a fashion or forme, that it signifieth such a thing is done by the enimie, or else that you must doo something, and in such a forme, that it signifieth such a thing, &c. accordingly vnto the tokens that you haue agreed vpon, &c. And furthermore, you may deuise by the formes of lightes in the night, to cause your friends to write a letter by, and so by that meanes to declare your whole minde vnto your friendes: as this, you hauing agreed vpon them, that if that there be so many lightes, and stand after such a fashion, that it signifieth to wright *A*, and if so many lightes, and in such a forme, then to write *B*, and so foorth vnto the numbers of the letters, according vnto the forme & number of the lightes so shewed, and then at the ende of euery word so written, to shew but one light for a stop, for the ende of a word, &c. vntill that you haue finished. And furthermore, in like manner by lightes in the night is the most speediest thing to haue any thing knowne, that may be to giue warning vnto any countrey to bee in a readinesse vpon the suddaine, as we here in England, doo prepare for the vse thereof, by the firing of the beacons, &c. And furthermore, it is vsed vnto a further practise vnderneath the king of Spaynes dominions, vpon the southe coast called *Andalazia*, within the straights of *Iuberal* are the sea being called *Mare Mediterraneum*, as there is small towers all alongst the coast that they doo keepe watch in, and at the ende of euery league or in lesse distance, there is one of those small towers: and it is so ordeyned amongst them, that they can tell whether that any of the Turkes, or Moores galleys hath been on the coast, and what number of Galleyes that there bee of them, and whether that they haue landed or been a shoare, and whether that they be gone or remayning still, by the very forme and the

numbers of lights, that the one tower doth shew vnto the other, and by this meanes of those lightes they will knowe of things done a hundreth leagues from them all alongst the coast in one night, for that the one of the towers dooth take of the other tower, &c.

### *The 76. Deuise.*

**A**ND furthermore, you being in a towne, if that you doo knowe that you shall bee besieged, you may make such prouision before hand, that you may send letters, and receiue letters of your friends from time vnto time, whereby that you may declare your pleasure and your estate to your friends, and also to know your friends minde, &c. as this, if that there is an Pigeon or Doue house in the towne, let them be well cherished before hand, and then carry a certaine nuber of those Pigeons vnto your friends, and in like manner take a certaine number of Pigeons from your friends, and then let them bee kept close in a house that they cannot get away, and when that you are besieged that you cannot send vnto your friends nor your friends vnto you, then when you list to send any letters, take one of those Pigeons, and make the letter fast about her necke, by some prouision, that it dooth not trouble hir wings, and so she will repayre vnto those Douehouses that she hath been cherished at, and hath been long vsing vnto, & then the Douehouse being searched euery night, you shall come by the letters, &c.

### *The 77. Deuise of Martiall affaires*

*by lande.*

**A**S touching Martiall affayres, I haue seene no greater experience, therefore I am more bolde than wise, for to say



say any thing therof, considering the great number of discrete & valiant Gentlemen and Souldiers, that hath been trayned vp of no small time in those affayres, that I being so simple & rude, should in any respect meddle therewith: but yet notwithstanding, they may make the lesse account thereof, and not enuy the rude writer of it, for that they be but written, as slender Deuises: and first this for to know, if that you haue viewed any peece of ground, to knowe how many men it will receiue to stand in their marching forme, according vnto *Tartalias* order that he describeth, and not according as *Nicolas Machanells* description, to allow for euery man three foote in breadth, & seauen foote in length, but according vnto the order of *Tartalia*, to allowe for euery man three foot in breadth, & but sixe foot in length. Wherefore I do think it necessary to know how many men will stand in their marching forme vpon any ground, for two necessary causes, & the one is this, if that you haue vewed the ground, & do know the length & the breadth thereof, then you may know how many men that it wil receiue, and by that meanes you doo know whether that it be big enough, or too small to serue your purpose, &c. And the second poynt is this, by that meanes you may know vpon the view of any ground, how many men that there be of your enemies, if that they be either in their battell forme, or in their marching forme, as they will bee alwaies if that they be going, except that it bee for pollicie sake, as if that they would shewe themselves to bee fewer in number than they are, then they will goe closer together than they doo of custome, and if that they would shewe themselves to bee more in number than they are, then they will goe wider asunder than of custome. And for to knowe how many men will stand vpon any peece of ground, doo this first, when that you doo knowe the length and the breadth of any peece of ground, how many foote that it is, then multiply them together, that is to say,

say, the number of feete of the length, with the number of feete of the breadth, and then looke what that number commeth vnto, and then deuide that number by 18. and that will shewe vnto you the true number of men, that will stand in their marching forme, according vnto *Tartalis* order, that is to say, to alow euery man three foote in breadth, and fixe foote in length, &c. and now according vnto our English measure, that is to say, to knowe how many men will stand vpon an aker of ground, as an aker of ground dooth containe of our land measure 160. rodes or poles, of 16. foote and a halfe in length, and that will make in square measure 208. foote and 8. ynches and better euery way square, so that there will stand vpon one aker of ground in their marching forme, alowing vnto euery man three foote in length and fixe in breadth. 2420. men, & after that rate you may know how many men will stand in any peece of ground, how bigge or small soeuer that the ground is, as a quarter of an aker wil receiue 605. men, so that lesse then seauen rodde of ground, will receiue 100. men, &c.

### The 78. Deuise.

**A**Nd furthermore, I do think it conuenient for to shew how many ranckes of men will bee in the length of a myle whereby that if you doo see the length of men in their marching, you may giue a very neare gesse of their number: as this, an English myle dooth containe 5000. foote, and then (as before is declared) to alowe for euerie ranke 6. foote, wherefore deuide the 5000. foote by fixe, and that will shewe vnto you how many ranckes of men will be in a myle in length, as it is 833. ranckes, so that you may conclude that there will bee 416. ranckes in halfe a myle, and 208. ranckes in the length of a quarter of a myle, and in the length 600. foote, iust 100. ranckes, and that is lesse



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lesse than  $\frac{1}{2}$  part of a myle, and then you knowing how many men that there is in a rancke, you may know the number of men, &c.

## The 97. Deuise.

**A**Nd furthermore I do think it conuenient for to shewe vnto you, how to set a battell square, that is to say, for diuers numbers of men, and the number of men being knowne, to haue so many men in a ranke, as the number of ranckes commeth vnto, and first for 100. the square roote, and so increasing by the halfe hundred, vnto 500. and then increasing by the 1000. vntill it be 40000. the first number is the number of men, the second is the square roote or battell, and the rest is the remainder that will not be square.

100	10000	100	10000	100	10000
200	40000	200	40000	200	40000
300	90000	300	90000	300	90000
400	160000	400	160000	400	160000
500	250000	500	250000	500	250000
600	360000	600	360000	600	360000
700	490000	700	490000	700	490000
800	640000	800	640000	800	640000
900	810000	900	810000	900	810000
1000	1000000	1000	1000000	1000	1000000
1100	1210000	1100	1210000	1100	1210000
1200	1440000	1200	1440000	1200	1440000
1300	1690000	1300	1690000	1300	1690000
1400	1960000	1400	1960000	1400	1960000
1500	2250000	1500	2250000	1500	2250000
1600	2560000	1600	2560000	1600	2560000
1700	2890000	1700	2890000	1700	2890000
1800	3240000	1800	3240000	1800	3240000
1900	3610000	1900	3610000	1900	3610000
2000	4000000	2000	4000000	2000	4000000
2100	4410000	2100	4410000	2100	4410000
2200	4840000	2200	4840000	2200	4840000
2300	5290000	2300	5290000	2300	5290000
2400	5760000	2400	5760000	2400	5760000
2500	6250000	2500	6250000	2500	6250000
2600	6760000	2600	6760000	2600	6760000
2700	7290000	2700	7290000	2700	7290000
2800	7840000	2800	7840000	2800	7840000
2900	8410000	2900	8410000	2900	8410000
3000	9000000	3000	9000000	3000	9000000
3100	9610000	3100	9610000	3100	9610000
3200	10240000	3200	10240000	3200	10240000
3300	10890000	3300	10890000	3300	10890000
3400	11560000	3400	11560000	3400	11560000
3500	12250000	3500	12250000	3500	12250000
3600	12960000	3600	12960000	3600	12960000
3700	13690000	3700	13690000	3700	13690000
3800	14440000	3800	14440000	3800	14440000
3900	15210000	3900	15210000	3900	15210000
4000	16000000	4000	16000000	4000	16000000
4100	16810000	4100	16810000	4100	16810000
4200	17640000	4200	17640000	4200	17640000
4300	18490000	4300	18490000	4300	18490000
4400	19360000	4400	19360000	4400	19360000
4500	20250000	4500	20250000	4500	20250000
4600	21160000	4600	21160000	4600	21160000
4700	22090000	4700	22090000	4700	22090000
4800	23040000	4800	23040000	4800	23040000
4900	24010000	4900	24010000	4900	24010000
5000	25000000	5000	25000000	5000	25000000

The Table for the 79 Deuife.

The number of units.	The Square root of the number.	The number of units.	The number of units.	The number of units.	The number of units.
100	10	0	10000	100	0
150	12	6	11000	104	184
200	14	4	12000	109	119
250	15	25	13000	114	41
300	17	11	14000	118	76
350	18	26	15000	122	116
400	20	0	16000	126	62
450	21	9	17000	130	100
500	22	16	18000	134	44
600	24	24	19000	137	231
700	26	24	20000	141	119
800	28	16	21000	144	264
900	30	0	22000	148	96
1000	31	39	23000	151	199
1100	33	11	24000	154	284
1200	34	44	25000	158	36
1300	35	4	26000	161	79
1400	37	31	27000	164	104
1500	38	50	28000	167	111
1600	40	0	29000	170	100
1700	41	19	30000	173	71
1800	42	36	31000	176	24
1900	43	51	32000	178	316
2000	44	64	33000	181	239
3000	54	84	34000	184	144
4000	63	31	35000	187	31
5000	70	100	36000	189	279
6000	77	71	37000	192	136
7000	83	111	38000	194	304
8000	89	79	39000	197	191
9000	94	164	40000	200	0



The 87. Deuise.

AND furthermore, for that the square roote or battell is not the strongest way for you to imbattell your selfe, for that the front is much narrower than the side or flank of the battell, wherefore in mine opinion, and also it is the opinion of diuers of them that haue written in Martiall affaires, that the strongest way for to imbattell himselfe, is to bee square vpon the ground, that is to say, that the side of the battell, and the front of the battell be as many foote one way, as it is the other way, and then the number of men in the front will be double vnto the number of the ranckes, and so by that meanes there be the more men occupied to fight all at one time, &c. wherefore I doo thinke it good to shew vnto you, how many men bee in a rancke on the fronte, and also how many ranckes that there will be in the side or flanke, and also in how many foote of ground square euery way, that they may stand vpon, accordingly as before is rehearsed, allowing euerie man three foote in breadth and sixe foote in length, beginning at 100. vntill that they bee 2000. and then increasing by the 1000. vntill that they be 40000. And the first numbers is the number of men, and the second is the number of men in a rancke for the fronte, and the third numbers, is the numbers of ranckes for the side or flanke, and the fourth numbers, is the remaine that will neither come in to bee a whole rancke in the fronte, neither will they bee sufficient to serue to make one more in a rancke. Wherefore they are to bee employed according vnto the will of the General or the Captaines of the leaders of those men, &c. and the fifth number is the number of the seate that those men may stand vpon in their battell forme, to bee square on the ground, that is to say, to be so many foote euery way, &c. And now followeth the table of the things rehearsed.

878	20	20	20	0008
204	22	22	22	0002

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The Table for the 20. Denie.

The number of feet that the ground is square	The R. e. number	The number of vetches	The number of men in a rank	The number of a m. the whole sum
42	2	7	14	100
51	6	9	16	150
60	0	10	20	200
66	8	11	22	250
74	0	12	25	300
78	12	13	26	350
84	8	14	28	400
90	0	15	30	450
94	4	16	31	500
103	5	17	35	600
111	16	19	36	700
120	0	20	40	800
126	18	21	42	900
133	10	22	45	1000
140	19	23	47	1100
147	0	25	48	1200
153	0	26	50	1300
158	22	26	53	1400
164	15	27	55	1500
170	4	28	57	1600
174	18	29	58	1700
180	0	30	60	1800
183	9	31	61	1900
189	16	32	62	2000
231	36	39	76	3000
267	40	45	88	4000
300	0	50	100	5000
328	5	55	109	6000
354	38	59	118	7000
378	62	63	126	8000
402	22	67	134	9000



The Table for the 80. Denier.

The number of men, the whole sum.	The number of men in a rank.	The number of ranks.	The 80. number.	The number of feet that the ground is square.
10000	140	71	60	423
11000	148	74	48	444
12000	155	77	65	464
13000	160	81	40	483
14000	166	84	56	501
15000	172	87	36	519
16000	179	89	69	536
17000	184	92	72	552
18000	189	95	45	568
19000	195	97	85	584
20000	200	100	0	600
21000	205	102	90	614
22000	209	105	55	628
23000	214	107	102	642
24000	218	110	20	657
25000	223	112	24	670
26000	228	114	8	684
27000	232	116	88	696
28000	237	118	34	710
29000	241	120	80	722
30000	245	122	110	734
31000	248	125	0	747
32000	253	126	122	758
33000	257	128	104	770
34000	261	130	70	782
35000	265	132	20	794
36000	268	134	88	804
37000	272	136	8	816
38000	275	138	50	826
39000	278	140	80	837
40000	283	141	97	848

## The 81. Deuise.

**A**Nd furthermore, as it is the strongest way for you to imbattell your selfe to be square vpon the ground, for that there is the more men occupied to fight, so in like manner it is the weaker way than to be square in number, if that you should haue any charge giuen vnto the flankes or side of the battell: wherefore I doo thinke it very necessarie for to shewe vnto you, how that the side of the battell may be as strong as the front, if that the weapons be sorted thereafter, for that they shall haue as many men in a rancke for the side, as there is in the front, vpon the suddaine, and the battell neuer depart from that ground, as this, the number of men in the front, being double vnto the number of ranckes, then if there bee any charge giuen vnto the side of the battell, the ground being square, then it is but to turne their faces vnto their enemies, and then two ranckes will make one iust: as for an example, of one hundred men, and to bee square vpon the ground, there shall be foureteene men in a rancke, and seauen ranckes, and the ground shall bee 42. foote square: then if that they haue a charge giuen vnto the side, then they turning their faces vnto their enemies, then they are but seauen in a rancke and foureteene ranckes, and then there is sixe foote a sunder betweene euery man, then let the next rancke come vnto the first rancke, and then there will bee foureteene men in a rancke, and so euery two ranckes may make one rancke, and then there is but three foote as was before betweene euery man in the front of the battell, and sixe foote betweene euery rancke, &c.

## The 82. Deuise.

**A**Nd furthermore, I do thinke it conuenient for to shew vnto you, how for to bee square vpon the ground, for any



Any number of men, what space soeuer that you would haue betweene man and man, both in length and breadth is according vnto the order of *Nicholas Machinel*, which is in length for euery man 7. foote, and in breadth 3. foot, or else if that you would haue your armie of men to shew bigger and to be square vpon the ground, then your space betweene man and man must be wider, as to allowe nine foote in length for euery man, and foure foote in breadth, according vnto the minde or fancie of the Generall, &c. Although the accustomed manner hath beene according vnto the opinions of diuers authors in Martiall affayres, to allow but 6. foote in length & 3. foote in breadth, called of most authors the broad square, according vnto the tables in the eightie Deuise. And now to be square vpon the ground, the what space soeuer that you would haue betweene man and man, both in length and breadth, then doe this first, looke how many foote that you will allow in length of ground for euery man, then you must multiply your number of menne, by the number of feete in length, that done, then deuide that number so multiplied by the number of feete in breadth that you doe allowe for euery man: and that done, then extract the square roote of that number, and that shall shewe you howe manie men shall bee in a ranck for the front of the battell, and then to know how many ranckes of menne, doo this, looke how many men that you haue in the ranck for the front, then deuide that number by your proper or true number of men, and that shall shew vnto you howe many ranckes that there shall be o' them, &c. As for an example thus; I hauing thirty thousand men, and I would know howe many men that there will be in a rancke, and howe many ranckes of them to be square vpon the ground, allowing for euery man 7 foote in length, and 3. foote in breadth, according vnto *Nicholas Machinels* order, and to knowe that, doe this, first your number of men being 30000. and allow-

allowing 7.foote in length for euery man, therefore multiplie 30000. by 7. and that commeth vnto 210000. and then deuide that number againe, by that number in feete that you do allow in breadth for euery man, and that is by 3. wherefore deuide 21000. by 3. and then there wil stand in the quantitie line 70000. then extract the square roote of 70000. and there will stand in the quantitie line 264. so that you may conclude that 264. men shall be in a ranck for the front of the battell. And now to know how many rancks of men that there shalbe for the side or flank of the battell, then doo this: your number beeing 264. men in a rancke, and your number of men being 30000. wherefore deuide the 30000. by 264. and then there will stande in the quantitie line 113. and then remaineth ouer 168. so that you may conclude, that 30000. men to stand square vppon the ground, allowing seauen foote in length, and three foote in breadth, for euery man, will be 264. men in a rancke, and 113. ranckes, and 168. men will remaine ouer, which 168. men you may imploy at the discretion of the Generall: and also it will make one man more in a rancke, and then there shall bee 265. men in a rancke, and 113. ranckes, and 55. men will remaine ouer, &c. And also by this order, you may imbattell your selfe square vpon the ground, what space soeuer that you would be between man and man in length and breadth: wherefore I will giue a second example, you hauing tenne thousand men, and would haue nine foote in length for euery man, and foure foote in breadth, wherefore multiplie tenne thousand by nine, and that maketh 90000. then deuide that 90000. by foure, and then there will stand in the quantitie line 22500. then extract the square roote of 22500. and then there will stand in the quantitie line one hundred and fiftie: so that you may conclude, that 150. men shall bee in a rancke for the front of the battell, and then your number of men, beeing 10000. therefore deuide the number of  
men



men by the front, that is to say, 10000. by 150. and then there will stand in the quantitie line 66. and then there remaineth ouer 100. so that you may conclude, that 10000. men, alowing euery man 9. foote in length, and 4. foote in breadth, to stand square on the ground, will bee 150. men in a rancke, and 66. ranckes, and 100. will remaine ouer, which 100. men will make one man more in a rancke, that is 151. men in a rancke, and 66. ranckes, and 34. men will remaine ouer, & so by this meanes you may in battell your selfe square vppon the ground, what space soeuer that you would haue betweene man and man both in length and breadth, and then if that you would know how many foot square in ground that they doo occupie, then it is but to doo this: multiplie the number of men in a rancke, by the number of feete that they doo occupie in breadth, & that shall shew vnto you how many foote square is the ground that they doo occupie, or els you may doo this: multiplie the number of rancks by the space of the number of feete, that they haue in length, & that in like manner shewes the square of the ground that they do occupie in like manner. &c.

*The 83. Deuise.*

**A**Nd furthermore, you hauing any number of men, and you hauing so many weapons of euery sorte more or lesse, as it happeneth, whether that you would be square on the ground, or otherwise, you knowing how many men that you would be in a rancke, you may knowe how many ranckes that there will bee of euery sorte of weapon at your pleasure, as this, that is no more but to deuide the number of weapons of euery sorte, by that number of men that you would be in a rancke, and that number that standeth in quantitie line shall be the number of ranckes: &c. And thus by deuiding euery sort of weapons by it selfe, by a number in a rancke, you shall perfectly know how many

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rancks

ranckes that there shall bee of euery sorte of weapon, &c. And thus I do cease to say any further, as touching the setting of the sorts of the weapons, referring that vnto them that are expert in those causes, and also the formes of sundrie battels, as triangles, double and single battell, called the halfe Moone, either with the hornes or corners forwards or backwards, and the sleeues or wings of battels. I will not take vpon me to deale in those causes, but I do referre that vnto those men of experience in such affayres.

*The 84. Deuise.*

**N**OW you beeing imbattelled in any place, where that you are neere vnto your enemies, and yet for an aduantage sake, you would take another peece of grounde more better for your purpose, and yet you cannot come vnto it in your battelforme by the means of some straight that you must passe through before that you can come vnto it, and for that you are imbattelled, and wou'd not alter them from that forme of battell: then to passe through the straight do this, the place being viewed before hand, how many men may march through in a rancke through that straight, and then appoynting your officers, as the Captaines of the hundreds, and the vintners, or the other officers for that purpose, to march through the straight, according vnto that number that you may march through, and then when that they doo come at the straight, let the whole battell stay, & then if that it be so narrow that there may but 3. men passe through, more or lesse as the place is, then begin at the side of the battell, and then let 3. of the front begin to enter and march in, and then 3. of the next rancke, and so forth vnto the last rancke, and then at the end of the last rancke, let them 3. of the first rancke follow againe, and so forth, vntill that they be all entred & gone into the straight, and then when that the first 3. in a rancke



## *and strange Deuises.* 75

is through the straight, let them stay, and then let the next 3. in a rancke come vp by them, vntill that hee that was in the front be with them that are in the front that first entered the straight, &c. and so let them all stay, and the one come vp by the side of the other, vntill that the whole battell be in that forme that it was before. &c.

### *The 8 s. Deuise.*

**A**Nd furthermore, if that you in the marching haue any occasion to shift the number of men in a rancke, that is to say, to be sometime more men in a ranck, and sometime fewer men in a rancke, and yet would keepe your weapons sorted as they were at the first, as in the Deuise next before in the passing through a straight, where the weapons that were in the front are disperfed in euery place, according vnto the often separating of the front of the battell, so that in that forme they are but weake, if that they were a-broade out of the straight where that they might haue any charge or battell giuen vnto them: wherefore for an easie way to shift your selfe to bee what number of men in a rancke that you list, and to keepe your weapons sorted as they were before, and not to bee altered, but them that were in the front to be in the front still, and so consequently in euery place to be as they were before, &c. And now for a speedie way for to bring your men from one number of men vnto another, this is to be noted, if that you bee 3. men in a rancke and would be 5. then 5. ranckes will make 3. ranckes: and you being 3. ranckes and would be 7. in a rancke, then 7. ranckes will make three ranckes: and being three in a rancke, and would bee nine in a rancke, then three ranckes will make one: and being three in a rancke, and would be eleuen, then eleuen will make three: and being three in a ranck, and would be thirteene, then thirteene will make three: and being three in a rancke, and would

be 15. then 5. ranckes will make one: and then if that you would be 17. in a rancke, then 17. ranckes will make 3: and if that you would be 19. in a rancke, then 19. will make 3: and if that you would be 21. in a rancke, then 7. will make one rancke, &c. And if that you be 5. men in a rancke, and would be 7. in a rancke, then 7. ranckes will make 5: and still you being 5. in a rancke, and would be 9. then 9. will make 5: and if that you would be 11. in a rancke, then 11. will make 5: and if that you would be 13. in a ranck, then 13. wil make 5: & if that you would be 15. men in a ranck, then 3. ranckes will make one, &c. And furthermore, you being 7. men in a rancke, and would be 9. then 9. ranckes will make 7: and you being still 7. and would be 11. then 11. will make 7: and if that you would be 13. in a rancke, then 13. will make 7: and if that you would be 15. then 15. will make 7: & if you would be 17. then 17. will make 7: and if that you would be 19. then 19. will make 7: and if you would be 21. then 3. ranckes will make one, &c. And furthermore, by that same order you being the more men in a rancke and would be fewer, then as is shewed before you being 21. in a rancke, and would be but 3. then one will make 7. ranckes: and if you being 21. men in a ranck, and would be but 5. then 5. ranckes will make 21: and if that you would be but 7. in a rancke, then one rancke will make 3. ranckes, &c. And so by this meanes you may alter your selfe from one number vnto another, and neuer vn-  
 sorte your weapons, as when that you list to alter your number of men in a rancke, then it is but to appoynt your officers in euery place at the ende of so many ranckes, to poynt them into what number that you doo assigne them &c. at your pleasure.

### *The 86. Deuise.*

**A**ND if that it happen when that you are set in your battell forme, and your enemies at hand readie to fight with



with you, and by fortune either of great Ordinance or by small got, that the front or diuers ranckes of your battell that the men are slayne or spoyled, and then if that your enemies doo encounter with you, then you must needs be ouerthrowne, except that the front and those ranckes bee new supplied or finished againe with men: neither you must not be out of order, for then in like manner you should be ouerthrowne: and to runne away then you in like manner should be ouerthrowne: wherefore this is to be noted, and that those that are the officers of the bandes haue a diligent foresight, that as soone as any mā is stroake downe by any misfortune, that the roome bee supplied againe forthwith: which way is this to be done, and neuer to be out of order for the matter, and the ranckes afore to be furnished forthwith, and this the Souldiers must haue this Instructions, that as soone as he dooth see his foreman stricken downe or missing, that he doth step into his place and so euery one of them to steppe forwards vntill that it doo come vnto the last rancke, and so by that meanes that those men, that were taken away in the first ranckes, that they shall be turned vnto the hindermost ranckes of all, &c. And this they may doo both in their marching or going, as well as in standing still, for in the going hee must goe faster than his fellowes, vntill that he dooth come so farre forwards till that the ranckes bee furnished againe, & if so bee that it were so, that in the first ranckes that the men were spoyled vntill the middle of the battell, should neuer cease but to ouer goe his fellowes, vntill that hee were in the forefronte of the battel, and so in al the ranckes, vntill the last ranke to come forwardes in like manner, and so by that meanes the wantes of men should be in the hinder part of the battell, and furnished in the forepart of the battell, &c.

*The 87. Deuise.*

AND furthermore, as touching the ioyning of battell, there is great policie, and wisedome, both in the sorting of their weapons, & also in the imbattelling of them, considering in what forme that your enemies bee in, and how that they are prepared both in their weapons and otherwise, and so you to imbattell your selfe against them, that you may haue the aduantage of them if that it be possible, considering of euery thing that may happen, as well of things that are against you, as of things with you, that is to say, considering of the number of men of both the sides, the furniture and the weapons on both the sides, the forme of the battels on both the sides, the aduantages of the groundes, whether that it bee by hill, or by any other meanes, as the winde, or the Sunne or water, or such other like, &c. And also there is great matters that may happen by the vsing of some kinde of fight, considering of the weapon on both the sides, for they must vse the fight of any weapon, according vnto that weapon that hee fighteth against, and so seeke the aduantage that waies if that it may bee: as in my opinion, if that there were two battels readie to bee ioyned together, the one against the other, and the number of men on both the sides to be equall, and also in their appoyntment weapons and furniture to bee a like, and also in forme of battell all one, and also the one to haue no aduantage of the ground of the other, neither in no other thing, but to be all alike in all poynts, &c. and suppose that the fronte of both the battels is pikes, and the one as many men in a rancke as the other, yet it is possible that the one may ouerthrowe the other at the first meeting of the battell without any recouerie, by the meanes of the order of the fighting: as this: the one battell commeth  
according



according vnto the accustomable manner, thinking to stand at the pushe of the pyke with them, and the other battell comming in that forme in like manner, vntill that they are in manner hard vnto them, and then vppon the suddaine, they doo all the fore fronte run in narrower and together so close as they can, comming in shoulder vnto shoulder, and then the ranckes that are behinde, for the quantitie of neare the halfe of the battell, dooth the like, and so dooth come close vnto the backe of them that are before, and so running with great violence, and the poyntes of their pikes forwards, that they must pearce and enter the fronte of the other battell, for they that are before must needes run in vnto them, for that they that are behinde doo force them in: and they that are of the other battell must needes giue way, or else fall downe and be troden vnder feete, and then if that they bee once separated, and put out of their order, they must needes be ouerthrowne without any recouery, &c.

Wherefore there is great policie to bee vsed in fighting at the ioyning of battels, and also in the sorting of their weapons, and also in the forme of the battels, as in the deuiding of themselves in sundry battels, as wings and such other like, which I passe ouer, referring it vnto those that haue seene the experience thereof.

*The 88. Deuise.*

**A**Nd furthermore, if that it happē so that you do chance for to be ouer matched, and that you doo knowe that your enemies bee to strong for you, by the great strength of their horse men, and the number of men to many for you, that if you should fight with them, that you must needes be ouerthrowne, then to preuent them that they shall not be able to giue any charge vpon you, then inui-

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ron or compasse your selfe round about with your carriages, that is to say, with your wagons or cartes, and so by that meanes the horsemen shall not be able to enter vpon you, neither the foote men, but that you shall bee able to defend them, &c. and if that it happen so that you haue not sufficient of wagons or cartes to inuiron or compasse you round about, then you may goe neare vnto some hedge or ditch, or such other like to bee your refuge for the one side, and then you may place your carriages on the other side, &c.

*The 89. Deuise.*

**A**Nd furthermore, if that it happen so, that you are abroad with a band of men, and that you are belayde betweene you and home, both by horsemen and by foote men, and that it is not possible for you, but if that they doo charge vpon you, but that you must be ouerthrowne, and you hauing no wagons or carriages to compasse your selfe, then repayre vnto such a place that is full of bushes, as thornes, and brambles, and there you may with ease defende your selfe, for that the Horsemen shall not bee able to giue any charge vpon you, and also as for the footemen you may defende your selfe, &c.

*The 90. Deuise.*

**A**Stouching this, if that it dooth happen so, that you are driuen to trauell by night, whether that it bee to doo any exployte or otherwise, and that you are small shot as harquebushes or caliuers, and that you would carry your match close, that you would not haue it to be seen of the scouters, or watch of your enemies, then you must doo this, euery man must prepare a peece of a cane of  
fue



five or fixe ynches long, and must put a string thereunto, and hang that by his girdle, as you doo the sheathe of a knife: and the peece of cane must bee open at both the endes, and then the matche being light, you must put into the hollow cane that ende that is light, and so the match will burne in the cane, and the light thereof nebee espied, &c. and this Deuise is very good to carrie your match in the rainie weather, for that the wet shall not touch the fire of the match, and you may euer, as the match burneth, feede it, or put it in further and further, &c.

*The 91. Deuise.*

**A**ND furthermore, if that you haue any watch or scouters abroade in the night, and that you woulde knowe whether that there be any horsemen comming, and the night being so darke that you cannot see if that any were comming, yet by this meanes you may knowe if that there were any comming, as this, make a hole in the ground with a dagger or knife, of a two or three ynches deepe, and a three or foure ynches ouer, and then stoupe downe vnto the ground, and lay your eare thereunto, and then you harkening vnto it, if that there be any horsemen comming you shall heare them, and you shall knowe whether that they doo come fast or softly, and whether that there bee one or two, or a number of them, by the very noyse of the ground, halfe a myle before that they doo come neare vnto you by the verie noyse of the ground: and also if that it be vpon some kinde of ground, you may heare them more than a mile, and also vpon such ground you may heare footemen a quarter of a myle, and whether that there bee but one or two or a number of them.

*The 92. Deuise.*

**A**Nd furthermore, as touching them that doo trauell by night in such places, that is, in their enemies countrey, and that cannot trauel by day for feare of being spied, neither dare keepe the common highe way for feare of being met withall, as it may happen by them that haue beene taken of enemies, and haue broken prison, or otherwise to carry letters, & such other like, then it behooueth them to knowe which way that the place dooth stand from them, that is to say, vnto what quarter of the world, whether that it be East, West, North or South, & then according as the place doth beare, so to direct their way, and according vnto that to coast ouer the Countrey the nearest way, & to gouerne them by night in their way, they must vse the North star, & so in the night to direct their way by that, if it be star light, & by day they may vse the needle of a Diall when they trauell in such places that be out of the hye way, as in wooddes, Forrests, & such other like places, and if that they haue no Diall, then they must note the place of the Sunne rising and the setting, and the place of noone, &c. vntill that they doo come neare vnto the frontiers of the Countrey where their friends are, &c.

*The 93. Deuise.*

**A**ND if an armed man be pursued, and is in danger to bee taken except that hee may swimme ouer a water, then for him to swimme, hee may prepare this, to make a thing to beare about him, as a girdle made of leather and sowed tight, and blowe that full of winde by a pype that must bee made fast therevnto, and so that thing will make him swimme, although hee haue an armout on his backe.

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*The 94. Deuise.*

**A**Nd if that an army of men and their carriages are to passe ouer a riuer or water, and they hauing no prouision of boates, yet they may make a bridge in this manner, first prepare caske, as pypes, or hogshedes, and then take long timber, and then make a frame therewith in this manner, to frame two peeces together somewhat shorter in breadth than the length of the caske, like vnto a ladder, but much bigger and stronger, and you hauing prepared a sufficient number of these, then take your caske being made tight, and then take those timbers so made together, and then put the caske betweene two of these framed timbers, the one being laide close vnto the other, and then make fast those two frames, the one being of the one side of the caske, and the other on the other side of the caske, and then make them so fast, that the caske will not stirre, and so to make it so long that it will goe ouer the riuer or water, and so to haue two ranckes of caske in those formes, and then those two ranckes of caske being placed crosse the riuer, then prepare planks to lay vpon those two ranckes of caske close together, and then being made fast vnto the timber that they doo not stirre from the place, then the whole armie may passe ouer, and their carriages and all, for that the caske will not suffer the bridge for to sincke, although that they doo drawe the Ordinance ouer it, &c.

*The 95. Deuise.*

**A**Nd furthermore, if that an army of men be for to passe ouer a broade water, where that there dooth runne a great tyde or streame, and by the meanes of the great breadth, and the swift streame, it is not possible to make

any bridge to passe ouer it, yet notwithstanding it is possible to carrie such prouision with them, that may make so many boates within lesse time than a day, as will carrie the whole armie ouer at once, although that the water were two or three myle ouer it, & yet that prouision that they should carry with them, should not aske any great matter in carriage, for one wagon or cart should carrie as much prouision to make boates to carry ouer 400. or 500. men, &c. As this, first, prepare leather, and then let them make the mould of a boate of 20. or 30. foot long more or lesse, at your discretion, and in deepenesse three or foure foot at your discretion, and of 8. foot broade more or lesse at your discretion, and that done, let the leather bee made like the moule of the boate, that it may be fitte to bee drawne on vppon it, and the seames so sowed or closed, that it dooth not leake, that it may bee tight to holde out water, and that done, then to haue in sundry places certaine strops or strings to make it fast, and then it is finished, and then it may be folded vp and laide in cartes or wagons, and then you may make such a number of them as shall bee sufficient to serue your turne, as a boate of 30. foote long, and eyght foote broade, and foure foote deepe, will carrie a 40. or 50. men at ease, &c. And then whensoever that you do meane to passe the army ouer any riuer, then repayre vnto some place neare vnto the riuer side, where there is some yong woodes, & then that shall serue your turne, to the intent to make your boates: as this, cut downe of that yong wood, and then cut one maine peece to make it for the keele of the boate, and to cutte that of that length according to the length of the moule that was first made, and so a peece for the stemme and the sterne post, accordingly vnto the first moule made, and then certaine poles to serue for the sides, and so forth, and so consequently to euery place, and then let them be framed and nayled together in all places, & that done let the leather



leather bee drawne on ouer that, and then made fast with the strops, and then it is finished: and then for that the men may not tread vppon the leather in the bottome of the boate, they may either prepare bordes, or els to make hardels of purpose, and then these boates being put into the water, they will swimme aswell as any other boates, and may rowe too and fro, if that it were to go 100. miles, &c. Wherefore they must make some prouision of oares for them.

*The 96. Deuise.*

**A**ND furthermore, as is before expressed in this booke of Deuises of Ordinance, that in the carrying of their field Ordinance, as their Sakers, and their Minions, and their other field peeces, that when that they doo trauell amongst their enemies, or otherwise in the front of their battels, when that they doo see that their enemies be ready to giue charge vppon them, eyther with their horsemen or footemen, they may drawe or carrie their field Ordinance before the battell, and their mowthes forwards and laden, and may shoote them off vnto their enemies, and yet the horses shall still drawe forwards, and be behind the Ordinance, so that their Artillerie shall goe forwards as fast as the armie of men, and alwaies in the front of the battell: as this, where as the accustomed manner is for to haue the Lymers that the horses doth drawe in, to bee made fast vnto the stocke or carriage of the peece, and so to drawe it with the breech or taile forwards: this must bee vnto the contrarie, for it shall haue no Lymers at al, but in the stead of the Lymers it must haue a long peece of timber, as of Fyrr, or such as they make masts of, & that must be made fast vnto the carriage or stocke of the peece, in such sorte that it doth stand fast, that it may not swaue by no means, and to stande backwardes right out from the taile of the

peece wards, and the peece of timber or mast to be of sufficient bignesse and length, according vnto the peece of Ordinance, and then they may make their prouision of their horse harneys fast vnto the long peece of timber, and the horses heads to goe towards the peece of Ordinance ward, the one halfe of the number of horses vpon the one side of the long peece of timber, and the other halfe on the other side, and then the horses in their drawing shall thrust the peece of Ordinance forwards, so that the horses shall goe behind the peece, and the mouth of the peece forwards towards their enemies, so that they may shoote them off continually without any staying, so that the horses will be ruled: but if that the horses will not be ruled, yet then they may be driven forwards by the long peece of timber, with the strength of men. &c.

*The 97. Deuise.*

**A**ND furthermore, as you doo see by the last Deuise, for the drawing of the Ordinance, and the peece for to goe before the Ordinance, so in like manner if that it should happen so, that you had no Ordinance with you, but had carriage with you, as wagons or carts, then in my opinion it were very good to bee set in the front of the battell, for the preservation of them against the horsemen, as before is sayd, to haue a long peece of timber made fast behinde the cart or wagon, and so to drawe it, and the cart or wagon to goe before the horses, &c.

*The 98. Deuise.*

**I**T furthermore seemeth vnto me to bee very necessarie, and especially for an armie of men that should travell amongst their enemies, or also where as any battell is to bee fought, my opinion is, that this kind of prouision were very necessarie both for the forefront of an armie, and also  
for



for to impale them rounde abouts, and that is this, for to prepare certaine small Ordinance, so that it be not too heauie, as Muskets and small single Baces, and some Calabasses that doo shoote small stones, as single and such other like. And then let them prepare small light wheeles of 4. foote hie, and so prepare an Axeltree for two of those wheeles, and place those small Ordinance vppon them in some handsome prouision made of purpose, and that done, then those small Ordinance may be driuen forwards with the mouth towards their enemies by men, for any mā may drawe or thrust forward 3. or 4. score pound waight, being vpon wheeles, better or with more ease than he shalbe able to beare 20. pound waight, & these small light Ordinance may be driuen forwards being vppon wheeles, as men doo commonly driue a wheelebarrowe, and so the mouth shall be forwards, and he behind the peece, and the peece may haue a sight as the Caliuers haue, so that he may shoote as neere with that peece, as they may do with a Caliuier: but the force of that peece is fixe times more than the force of the Caliuier, so that it is not possible for to make any armour of prooffe to keepe out the force of that shot: wherefore I am of this opinion, that being vppon plaine ground, that any man may trauell as far in a day with a small peece with all his prouision with him, as any man with a corselet furnished: for he that trauelleth with that peece may hang all his prouision of powder and shot vpon the Axeltree of his peece, and so traue with ease: & also any armie of men being inuironed round with such kind of prouision, with the helpe of the other Ordinance & prouision before specified, that it is not possible for any horsemen to enter in vpon them, but that they may defend them, for the horses cannot run ouer the wheeles, and carriage of this kinde of small Ordinance, but that they that are within those small Ordinance, may defend them with their pikes and Caliuers, and their other weapons, &c.

*The 99. Deuise.*

**A**Nd furthermore, as touching the force of horsemen, when that they doo giue the charge vppon any band of men, they doo come with no small force, the horses being lustie and strong: wherefore some mens opinion hath been this, that if that the pikemen, for that they are the strength of the armie, and especially to defend the horsemen, that if that euery pikeman did prepare a bladder blowne, and a few peason in them, and so made fast hard vnto the head of the pike, and so shaking the pike, the pease in the bladder will make a great noyse, and so feare the horses, that the horses will skant come vppon them that haue their pikes in that order, the lustier horses the more they will be feared, except that they be the better broken vnto those causes, &c.

*The 100. Deuise.*

**A**S touching this, to knowe whether that any ground be hier or lower than the ground that you do stand vpon, that is knowne by that order, as in the first Deuise by the line of the Horizon, that alwaies looking and marking, how the furthest part that you doo see, doth cut vpon that ground that you doo desire to knowe, whether that it bee hier or lower, and looke at what heighth you doo see the Horizon, that is equall in heighth with the sight of your eye, and then rebating that heighth vpon the other ground, then that is equall with your feet, and if that you doo see the Horizon circle ouer the other ground, then the ground is lower than the ground that you doo stand vpon, &c. And also if that you are amongst hilles, and that you can not see the Horizon circle, then you may knowe whether that it bee hier or lower, by a square, hanging a plummet  
of



of leade at the corner, and set the edge of the square iust with the line, and then take your sight by the vpper part thereof, and so beholding the place, you shall knowe whether that it be hier ground or lower, &c.

*The 101. Deuise.*

**F**OR to knowe whether that it bee possible to bring the water of any spring vnto any place assigned, it is thus knowne, or to knowe how hie that it may be raised, it will alwaies come vnto any place that is any thing in lownesse vnderneath the place that the spring commeth foorth of, and it may in like manner be raised in heighth at your pleasure, so that it be any thing lower than the head thereof, allowing for a mile in distance to the head of the spring, to bee three inches and a halfe hier than the place that you would raise it vp vnto, and for two miles 14. inches, &c. from the circularnesse of the earth, &c. and for to knowe whether the ground bee hier or lower, it is declared in the Deuise going before.

*The 102. Deuise.*

**A**ND also the principallest annoyance that you can doo vnto any towne that is besieged, is to take away their fresh water, whether it be by any riuer or Conduits: & to take away a water course or riuer, this must be considered: first view the ground that the same doth passe through, & that done, looke where there is any ground lower or inferior in heighth vnto it, and also how the passages may be led besides the towne, & not to seeke to the towne wards againe, and then cut trenches or ditches to leade or carrie the water another way: and that done, make a damme at that place you mean to stop the water, to turne the course, that it may goe besides the towne, as alwaies water is apt

to seeke vnto the place any thing lower than it selfe: but if that it happen so that the water course is betweene two hills, that there be no roome to turne the water from the town, then you may poyson their water with diuers things that the same may annoy them, but if that they haue water brought vnto them by conduits, then you may but digge betweene the conduit head and the towne, and cut the pipes thereof, and so by that meanes for to take away their water. And this is one of the principalest annoyances that you may doe vnto any place, &c.

*The 103. Deuise.*

**F**OR that I doe think it very necessary and comenient, for to shew vnto you howe for to knowe what waight that you are able for to payse or lift vp from the grounde, if that is to say, to let the one end vnder it, and to wey or presse downe the other ende, that it were after the order of colepresse wise, that is to say, to let the one ende vnder it and to wey or presse downe the other ende, for that it is vsed many times about the lifting of great and heauy things, as the lifting of great and heauy Ordinaunce, or great and heauy timber or stones, and it is thus knowne, how much or what weight that it will lift or payse vpe: looke how much of the colepresse is more ouer that which beareth the thing vnderneath, more the one way than it is the other way, so accordingly vnto that proportion the thing will be lifted, as the thing of 100. waight, laying the coale-presse thereafter, wil wey vpe a 1000. waight, yea 5000. as you doe place the thing for the purpose: As for an example, this the thing that I haue for to lift vp is a 1000. waight, and the peece of timber that I doe make my waving tree that it is eleauen foote long and better, wherefore I doe place the block or thing vnderneath at one foote, from the thing that is to be lifted, and so I doe lay



lay the waying tree that it is 10. foote ouer the one way, and but one foote the other way, and lying in that forme a 100. waight will wey vp the 1000. waight, and by this order you may make your prouision in that sorte, that you may lift any thing at ease, &c.

*The 104. Deuise.*

**A**ND furthermore, in like manner you may knowe what wayght will bee lifted with a wheele: as this, looke how much in Deametre or in circumference that the wheele doth excede the axeltree that the roape goeth about, so much in proportion shall the wheele lift the lesser waight, to raise or lift the bigger: as for an example, a wheele of 12. foote in Diametre, and hath an axeltree that the roape goeth about of one foote in Deametre, then a person that wayeth a little more than 100. waight to goe in the wheele, shall wey a thing of twelue hundreth waight, and according vnto the compasse of the wheele, and the compasse of the axeltree, that the lesser waight will wey vp the bigger: and the like effects be in the often foldings of roapes, for to runne in pulleys, as wee may see by the tackles of shippes, &c.

*The 105. Deuise.*

**A**ND also in wheeles, if that one wheele doe turne another, you may know by the one wheele, how oftentimes that the other wheele shall turne it about, whether that the wheeles doe turne or goe by teeth, or as some doe terme them by cogges, or by a roape or line, &c. As this, if that the one wheele doth turne the other by teeth, then it is knowne by the number of teeth, taking in the other wheele, as if the nūber of teeth of the one wheele be double vnto the other, then for the one wheele in the going about

about one time, the other shall bee turned two times, &c. And if that it be so that the number of teeth be ten times the lesser, then at the going of the bigger wheele one time the lesser shall bee turned tenne times abouts: and in like manner, if the number of teeth were 100. times the number of the lesser, then for the once going about of the one, the other shall bee turned 100. times, alwaies according vnto the number of the one, by the number of the other, proportion for proportion, accordingly vnto the number of the teeth in both the wheelles. &c.

*The 106. Denise.*

**A**Nd also in like manner you may knowe, how many times that one wheele dooth turne the other wheele about, that the one wheele doth turne the other wheele by a rope or line, or by a chayne, or such other like, as this by the circūference of both the wheelles; for if the one wheele bee double the circumference, or compasse of the other, then for the going of the bigger wheele once about, the lesser shall turne twise about: and furthermore, if the bigger be ten times the compasse of the lesser, then for the going of the bigger wheele one time, the lesser shall turne ten times about, &c. accordingly vnto the circumference or compasse of both the wheelles, proportion vnto proportion, &c.

*The 107. Denise.*

**A**Nd furthermore, it is possible for to place a glasse in a chamber or a parter in a house, for to see any thing abroad in the fields, or if that it be neere vnto any haven or riuer where as shippes or boates doo passe too and fro, that they may see in the glasse within the house, the things that are abroad, as playnely as if that they should goe  
abroade



abroade and get them vp vnto some high hill, or high tower, for to see them of purpose, the which thing is very necessarie, either for men of Honour or Gentlemen for to beholde in their chambers what is abroad in some such partes of their ground, as they haue any pleasure for to beholde and see into it, what is stirring: therefore that quantitie that it will shewe as their Deere in their parkes, or cattell in their pastures, or what persons that there is stirring in their Gardens or Orchardes: and also it is very necessarie for a Captaine or the Generall of a Towne, Forte or Castell, whether that it be in such places, that is, within the lande, or that they haue any charge to looke towards the sea or hauen, or riuer, it is very necessary for them, for that the glasses may be so placed, that they may see if that there bee any ships comming or going in the sea, riuer or Hauen, or any persons in the high way. But the greatest impediment that the glasses haue, you shall see no great circuite of ground in compasse, except that the glasses be very large, and also the windowe that the sight commeth in at, be large in like manner, &c. And furthermore, for the placing of a glasse in a chamber or parlour, to see the things abroad, it must bee thus done, first you must prepare diuers glasses of a great proportion, that are very perfect and good looking glasses, either of Steele or Christall, and that done, the place must bee viewed where that it must stand, for it is not possible to place a glasse in some chambers to see any thing abroad, but it must be in such a chamber as is conuenient for the purpose, that hath a very high rouse, and that hath windowes that are of a great heigh from the floore, or else some high Tower neare vnto it, &c. And if that the place be conuenient for that purpose, then this you must doo first, the place must bee assigned that you would see in the glasse, and then whether the place bee farre of or nearer, then you must place the first glasse alofte against a win-

dowe that is open vnto that place, and that done, if that it be very high, then turne the shadowe of the glasse accordingly as you doe see cause for your purpose, bringing the beame downewardes: and agaynst that glasse place an other glasse to receyue the beame or shadowe, of the thyngs abroad, and that done, you may turne the beame or shadowe of that glasse downewardes vnto what place that you liste, and so place another glasse agaynst that at your discretion, and so to place as many glasses, vntill that you haue brought it vnto the place that you woulde bryng it vntill, and then to sette all the glasses fast, for if that any of them bee sturred neuer so little, then the beame or shadowe will be turned out of the glasse, &c. And by this meanes you may conuey the beame or shadow of any thyng by glasses made of due proportion from one place vnto another, vntill that you haue brought it vnto what place you doe desire at your pleasure, and so by that meanes to see in a house what things be abroad.

*The 108. Deuise.*

**F**OR to cause yron, leade, stone, or any kinde of mettall what soeuer it be, to swimme in the water, without the ayde of any thing to support it or beare it, is this to be done, to make it hollow or concaue lyke a boll, or boate, or a trough, or what shape so euer that it haue, vntill that the sides may be raysed so hie, that the water can not come ouer the toppe of the side, vntill that there is the magnitude or quantity of the rate for euery foote square to bee in waight vnder. 50. pound, and the more that it is lighter the better it swimmeth, and then it will swimme without any fayle, &c.

*The*



## The 109. Device.

As it is not unknowne in respect vnto all persons, that you may burne any thing that is apt to burne with a glasse at hand, which is done by the Sunne beames pearling through the glasse, for that the Sunne beames bee united and knit all together in the center thereof, which is the very cause that it burneth, and as we doe read that *Archimedes* burned the Romane Naue at *Syracusa* in the Iland of *Sicilia*, some haue supposed that he did burne the with such kind of glasses, which is most vnpossible: wherefore it must needs be, that they were burned with diuers glasses, and the reflection of the Sunne beames turned vnto them. But this is to be noted, that it is possible that fewer glasses may serue to burne any thing there in that Latitude, than that it will doo here in this Latitude, for that the Sunne beames be more hoter: for the Latitude of *Syracusa* is but five and thirtie degrees and a halfe, and to burne any thing any great distance off with glasses, it requireth to haue some sight in Geometrie, or els it is not possible for to doo it, and for to burne any thing that is apt to burne, it must be thus handled: they must prepare a number of glasses made of metall, such as the common people call of Steele, made of purpose, and well polished, and to place those glasses to burne, as if that it were gunne powder, flaxe or towe, or occom, pitch, tarre, or such like things that will take fire quickly, the Sunne shining very bright: then set the glasse against the Sunne, and then turne the reflection beame or shadowe to the place assigned that you would burne, and then place another glasse in the like manner, and turne the reflection beame or shadow vnto that place in like manner, right vpon the first ende of the beame or shadowe, and so to place more glasses, and to bee sure that

that all the reflected beames or shadowes doo rest vppon one place, and so by a great number of glasses to multiply the heate, that in the ende it will bee set on fire and burne: but you must be sure that all the reflected beames or shadowes doo rest in one place, or else it will be vnto no purpose, and at a great distance you shall haue much to doo to decerne or see it, &c. Wherefore you must haue the ayde of Geometry, to vse it according vnto the distance, and to place the glasses in a frame, which I doo omit at this time for breuitie.

### The 110. Deuise.

**F**OR to see any small thing a great distance of from you, it requireth the ayde of two glasses, and one glasse must be made of purpose, and it may be made in such sort, that you may see a small thing a great distance of, as this, to reade a letter that is set open neare a quarter of a myle from you, and also to see a man foure or fise miles from you, or to view a Towne or Castell, or to see any window or such like thing fixe or seauen myles from you. And to declare what manner of glasses that these must bee, the one glasse that must be made of purpose, is like the small burning glasses of that kinde of glasse, and must bee round, and set in a frame as those bee, but that it must bee made very large, of a foute, or 14. or 16. inches broade, and the broader the better: and the propertie of this glasse, is this, if that you doo behold any thing thorow the glasse, then your eye being neare vnto it, it sheweth it selfe according vnto the thing, but as you doo goe backwardes, the thing sheweth bigger and bigger, vntill that the thing shall seeme of a monstrous bignesse: but if that you doo goe to farre backe, then it will debate and be smal, & turne the fashion downewards. But now to vse this glasse, to see a small thing a great distance, then doo this, the thing or place



place that you would view and discern, set that glasse fast, and the middle of the glasse to stand right with the place assigned, and be sure that it doo not stand oblique or awry by no meanes, and that done, then take a very fayre large looking glasse that is well polished, & set that glasse directly right with the polished side against y<sup>e</sup> first glasse, to the intent to receiue the beame or shadow that cometh thorow the first placed glasse, and set it at such a distance off, that the thing shall marke the beame or shadowe so large, that it may serue your turne, and so by that meanes you shall see in the looking glasse a small thing a great distance, for if that the first placed glasse be well made, and very large, you may descerne and knowe the fauour or phisnomic of a man a mile off from you: wherefore in my opinion, this is very necessary in diuers respects, as the viewing of an army of men, and such other like causes, which I doo omit, &c.

*The 111. Deuise.*

FOR to make a crane, engine or ginne, to wey any great waight, you may knowe before hand what it will wey, as in the 109. Deuise, and also you may multiply the thing in such sorte, that you may make a 100. waight to wey or lift vp 20000. yea 100000. waight if that you will, as thus, the crane or engine that hath a wheele of 12 foote in Deametre, and the axeltree is a foote in Deametre, now one person going in the wheele of any thing more than 100. waight, will way 1200. waight, and then you making another wheele of that Deametre, and the axeltree also, and a rope to goe about the circumference of the first wheele, vnto the axeltree of the next wheele, then that person to goe in that wheele, will way or lift 14400. And furthermore, if that you doo make a thirde wheele of that Deametre in all poyntes, then that person  
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going in that wheele, should wey or lift vp. 172800. and that contayne. 86. tunnes, but then it will ryse but very slowly, and that thing that doth beare or support it vnderneath, had neede be very strong to beare such a huge weyght, and also the first wheelles: and by this order you may multiply the thing to lift wayght infinitely.

*The 112. Deuise.*

**A**ND furthermore, you may make an engine to thrust from you or to pull vnto you, to lift vp or to presse downe with great force, eyther to goe with wheelles as before is declared, or else to goe with skrewes, or to goe with both, as to thrust open huge and strong gates, or else you taking good hold, to pull them open vnto you wards, and will make but little noyse in the doying thereof, but you must be sure to set the engine fast, if to thrust from to be strongly and well backed, and to pull to them it must be strongly bolstered before, sufficient to be of force to serue the turne.

*The 113. Deuise.*

**A**S touchyng the making of any strange workes that the world hath maruayled at, as the brasen head that did seeme for to speake: and the Serpent of brasse for to hisse: or a Doue of woodde for to flie: or an Eagle made by arte of woode and other mettall to flie: and byrdes made of brasse, tinne or other mettall to sing sweetely, and such other lyke Deuises, some haue thought that it hath bene done by inchantment, which is no such thing, but that it hath bene done by wheelles, as you may see by clockes, that doo keepe tyme, some goyng with plummets, and some with springs, as those small clockes that be vsed in tablets to hang about mens neckes. And as the  
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## *and strange Deuises.* 99

brassen head, that seeme for to speake, might bee made by such wheele work, to go ei:her by plummets or by springs, and might haue time giuen vnto it, that at so many houres end, then the wheeles and other engines should bee set to worke: and the voyce that they did heare may goe with bellowes in some truncke or trunckes of brasle or other mettall, with stoppes to alter the sound, may bee made to seeme to speake some words, according vnto the fancie of the inuenter, so that the simple people will maruell at it. And for to make a bird or foule made of wood & mettall, with other things made by arte, to flye, it is to bee done to goe with springs, and so to beate the ayre with the wings as other birds or fowles doe, being of a reasonable lightnes, it may flie: and also to make birds of mettall to sing very sweetly, and good musicke, it may bee done with wheeles, to goe at any houre or time appoynted by plummets, and then to haue pipes of tinne or other fine mettall to go with bellowes, & the pipes to haue stops, and to go with a barrell or other such like deuise, and may bee made to play or sing what note that the inuenter shall thinke good when he dooth make it: and also there may bee diuers helpes to make it to seeme pleasant vnto the eares of the hearers, by letting the sound or wind of the pipes to passe through or into water, for that will make a quauering as birds do. &c. And also you may make a small puppet, either like a man or woman, to seeme to goe by wheeles and springs, and shall turne and goe circular according vnto the setting of the wheeles and springs, and also the birds made to flie by Arte, to flie circularly, as it shall please the inuenter, by the placing of the wheeles and springs, and such other like inuentions, which the common people would maruell at, thinking that it is done by Inchantment, and yet is done by no other meanes, but by good Artes and lawfull.

*FIN IS.*